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Assistive technology for students with disabilities: Resources and challenges encountered by teachers

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ASSISTIVE TECHNOLOGY FOR STUDENTS WITH DISABILITIES: RESOURCES AND CHALLENGES ENCOUNTERED BY TEACHERS

A Dissertation

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

Approved:

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ABSTRACT

Assistive technology may be a solution for students with disabilities who are struggling to achieve academic growth; however, the consideration for assistive technology process is not prevalent in schools.

The purpose of this qualitative study was to take an in-depth look at the processes and factors that teachers of students with disabilities used in considering, adopting, and utilizing assistive technology to meet the needs of their students. Three teachers in one rural school shared the resources and challenges they encountered in the assistive technology process. Furthermore, using Rogers's Diffusion of Innovation Theory and Davis's Technology Acceptance Model as theoretical frameworks, this study looked at the factors that influenced the assistive technology process for these teachers.

Five themes emerged from the data analysis. These themes were diversity in shared assistive technology experiences, IEP team guides the assistive technology process, reliance and resources, academic and student independence benefits, and limited awareness of assistive technology as a significant barrier. Implications from this study were this lack of a systematic and uniformed process might limit in the teachers' exploration of possible assistive technology supports; and teachers without knowledge, time, and communication channels might slow the adoption process of assistive technology.

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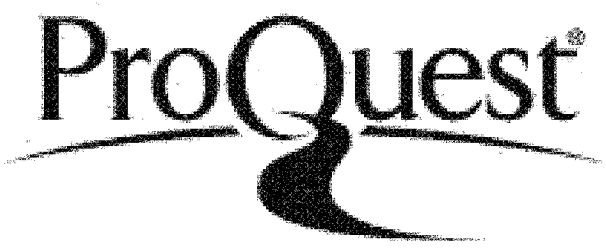

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This dissertation is dedicated

to my family.

Thank you for all your love, patience, and understanding.

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The three participants of this study deserve a big thank you. They took time out of their busy schedules to meet with me and share their stories. I appreciate all the information all three provided.

I will be forever grateful for the support of my immediate and extended family. Most importantly, the support of my husband, Kirk, permitted me to concentrate on my studies and my dissertation. He picked up the slack (and there was a lot of it) when I was overloaded with work and tolerated my absences from family time. I am also grateful to

my three terrific daughters and wonderful son-in-law who have tolerated and supported me through the process over five long years. Last, a special hug to the world's best grandchildren for patiently waiting for grandma to play; you will not have to wait anymore.

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PERSONAL STATEMENT

Teaching was not my first career choice. It was my mother's choice for me, and, of course my mom was right. I first started in the classroom as a substitute teacher and was soon asked if I would teach in a special education classroom. Since I had taken an introductory to exceptional persons class, I felt I was prepared. I quickly learned I was not prepared, but I also fell in love with teaching students with special needs. It was challenging to try a variety of approaches to meet a student's needs. I taught students with disabilities for 17 years with the last 10 years focusing on students with significant cognitive disabilities.

The students with significant cognitive disabilities challenged me to find different ways to help them to communicate, to walk, to eat, and to do what their peers were doing. This challenge led me down the path of assistive technology. This path was pretty lonely as there were not many helpers or supports along the way. I was fortunate to have guidance from an Area Education Agency (AEA) physical therapist and assistive technology consultant. However, these people were only assigned to be in our school district once or twice a month.

I searched for information and devices to help my kids feel successful. I spent many hours creating low tech devices by modifying materials in the classroom. When there were funds available, I would purchase an assistive technology device that I had researched. Unfortunately, these devices were expensive and were not always the best match for what the student needed, so the device was eventually abandoned. It was frustrating and time consuming, and I felt like I was letting the students down.

Five years ago I began teaching preservice and inservice teachers seeking special education endorsements at Upper Iowa University. I made a promise to myself to increase my students' awareness of assistive technology devices and services.

When I began my doctorate program, I knew I wanted to explore assistive technology as my dissertation topic. In particular, I wanted to know how other teachers navigated through the process of obtaining and utilizing assistive technology to meet the needs of their students. I wanted to know the resources and challenges that teachers encountered. My goal is to utilize the knowledge acquired through this study to help me be a better teacher to my post-secondary students. Achieving this goal will help me fulfill my promise to increase awareness of assistive technology devices and services in my post-secondary students, which in turn will benefit students with disabilities.

CHAPTER 1

INTRODUCTION

Technology is being developed at an amazingly fast pace in the world today and has created many opportunities for its users. Students with disabilities are one of the user groups benefitting from the opportunities provided by this technology explosion. Technology, in particular, assistive technology, can provide many possibilities for students with disabilities to experience opportunities which had previously been non-existent or, at best, limited to them. These students rely on their teachers to provide the necessary assistive technology devices and services to access the available resources.

As a result of the passage of the Technology Related Assistance for Individuals with Disabilities Act (The Tech Act) in 1988, the general education curriculum has become accessible to students with disabilities. The Tech Act was critical for students with disabilities as it provided the first definitions of assistive technology devices and services which remain in the legislation today. These definitions and the funding provided in the Tech Act afforded to students with disabilities the opportunities to utilize assistive technology devices and services. This accessibility can potentially increase student levels of inclusion, independence, academic skills, and quality of life. Subsequently, the American with Disabilities Act of 1990 extended accessibility standards to both the public and private sectors. The Tech Act was amended in 1994 to strengthen the demands placed on states to improve services to individuals with disabilities and to better enable access to assistive technology.

In response to the increase in technological developments, the 1998 Amendments to Section 508 of the Rehabilitation Act required all federal electronic information to be accessible in a variety of formats to provide equal access to people with disabilities, including students with disabilities, outside the realm of the school setting. The Assistive Technology Acts of 1998 and 2004 continued to ensure access to assistive technology devices and services and increase awareness of assistive technology. The Assistive Technology Act of 1998 influenced services provided to students with disabilities by providing better coordination among and between agencies in the state to ensure students with disabilities are provided the opportunities to access assistive technology. The Assistive Technology Act of 2004 remains important to students with disabilities because its primary purpose switched from applying the majority of funds toward establishing systems to directly helping students with disabilities obtain the necessary assistive technology devices and or services.

The most significant legislation was the Individuals with Disabilities Education Act of 1990 (IDEA), which ensured that a free and appropriate public education was provided to students with disabilities in the least restrictive environment. Students with disabilities were afforded inclusion in the general education classroom and curriculum by utilizing assistive technology devices and services. The Individuals with Disabilities Act of 2004 impacted students with disabilities by mandating the Individualized Education Program (IEP) team consider whether the child needed assistive technology devices and services.

These legislative acts revealed significant and numerous federal initiatives to ensure individuals with disabilities were afforded equal educational opportunities through the provision of assistive technology devices and services. In particular, IDEA required IEP teams to consider how assistive technology could enhance educational opportunities in the least restrictive environment. Placement for a student with disabilities is where the student will receive special education services. The least restrictive environment principle of IDEA mandates that a student with a disability have the opportunity to be educated with nondisabled peers, to the greatest extent possible. These considerations are formalized in the development of a student's IEP as placement considerations for the delivery special education services are identified. First consideration must always be consideration of the child's neighborhood school and the general education classroom. However, if this placement is deemed inappropriate by the IEP team, the school must offer a continuum of placements ranging from the general education classroom to placement at a residential treatment school.

In order to meet the requirements of the IDEA, the IEP teams must be familiar with the legal requirements and the expansive array of assistive technology devices and services available to students with disabilities. Assistive technology has been categorized in a variety of ways. Bryant and Bryant (2003) conceptualized assistive technology into three components: what it is, how it is made, and how it is used. The seven categories within the three components include positioning, mobility, augmentative and alternative communication, computer access, adaptive toys and games, adaptive environments, and instructional aides. The categories are based on how assistive technology is used by a

student with disabilities. Poel (2007) outlined the switch from the medical model to the Human Function Model, which emphasized what an individual could do instead of focusing on the limits of their disability. The purpose of this model was to look at the individual and figure out how assistive technology could enhance the capability of a student with disabilities to function within the environment. Blackhurst (2005b) identified six distinct types of technology that impact education including the technology of teaching, instructional technology, assistive technology, medical technology, technology productivity, and information technology.

In an attempt to establish a common mode of categorizing assistive technology, a continuum was explored with examples of low-tech, mid-tech, and high-tech devices. Low-tech devices may include non-electric devices, mid-tech may include non-complicated mechanical devices, and high-tech may include devices that incorporate sophisticated electronics or computers as tools for students with disabilities (Dell, Newton, & Petroff, 2008).

Nearly all researchers and other authorities who are knowledgeable on assistive technology (Behrmann, 1994; Blackhurst, 2005a; Derer, Polsgrove, & Reith, 1996; Edyburn, 2005; Todis, 1996) concur that the quality of education and the quality of life potentially improve with the utilization of technology for students with disabilities. One of the greatest benefits of assistive technology may be its capacity to enable students with disabilities to access a task that could not have been done before, or reach a specific ambition that otherwise would not have been possible (Copley & Ziviani, 2004). Assistive technology can foster access to learning benefits by compensating for reading,

mathematics, writing, spelling, and other difficulties (Bryant, Bryant, & Raskind, 1998; Bryant & Seay, 1998; MacGregor & Pachuski, 1996). Learning benefits included rate of engagement, level of productivity, and skill acquisition. Various studies utilizing assistive technology devices including software (Boon, Burke, & Fore, 2006; Hetzroni & Shreiber, 2004), speech generating devices (Schlosser & Blischak, 2004), and video modeling (Cihak & Bowlin, 2009) support the claim that assistive technology provides access to learning benefits. Social interaction benefits gained through the use of assistive technology were reported to include an increase in the inclusion of students with disabilities into the general education setting (Behrman, 1998; Friend & Bursuck, 2009; Hutinger, Johanson, & Stoneburner, 1996). Assistive technology can also provide greater opportunities for socialization for students with disabilities (Lahm & Nickels, 1999).

Another benefit from utilizing assistive technology with students with disabilities is the increase of self-management skills (Morrison, 2007). Assistive technology devices and services offer a variety of potential opportunities for students with disabilities by enhancing their educational opportunities. Teachers need to be cognizant of the learning, social, and self-management benefits obtained by students using assistive technology and utilize the rewards of these benefits as they plan, teach, and provide learning opportunities for students. Teachers need to challenge themselves to explore assistive technology devices and services that will increase academic, social, and self-management skills for students with disabilities.

While it is recognized that assistive technology can have a positive influence on a student's learning, a well-documented gap exists between the potential influence of

assistive technology and the actual influence of assistive technology supports for students with disabilities (Morrison, 2007; Edyburn, 2000a, 2004; Zambala et al., 2000). Barriers to the provision of assistive technology include fiscal restraints, equipment barriers, teacher barriers, and the individual as a barrier. Funding assistive technology devices can be an issue, especially with the ongoing costs of many assistive technology devices and services. Barriers pertaining to the high costs associated with obtaining assistive technology devices were identified in studies conducted by Derer et al. (1996) and Wehmeyer (1999). Another obstacle to assistive technology is a lack of funding, specifically identified in the federal mandates such as IDEA, which could have eliminated fiscal restraints (Stead, 2009). Equipment barriers include an uncertainty regarding the efficacy of assistive technology devices and a teacher's unfamiliarity with the current explosion of assistive technology devices and services available. The lack of research regarding the effects of utilizing assistive technology with students is a concern (Fuhrer, Jutai, Scherer, & Deruyter, 2003).

"The success of students with disabilities with AT is related directly to the AT knowledge, skills, and dispositions of special education teachers" (Michaels & McDermott, 2003, p. 29). This statement encompasses many of the teacher barriers explored in this study. The individual becomes a barrier when they are not matched with the correct assistive technology device or service or when the user has no motivation to utilize the assistive technology (Scherer & Craddock, 2002).

Possibly the most significant barrier to the provision of assistive technology was a teacher's lack of knowledge. Students with disabilities who could use assistive

technology cannot realize the benefits unless teachers are able to integrate assistive technology into their teaching practices (MacGregor & Pachuski, 1996). Teachers need to be aware of the legal factors, the extensive array of assistive technology devices and the benefits assistive technology can provide. Research suggests teachers have limited opportunities at the pre-service and in-service levels to acquire the knowledge necessary to navigate through the process of considering and obtaining assistive technology for students with disabilities (Bausch, Ault, Evmenova, & Behrmann, 2008). Teachers reported limited knowledge of assistive technology devices and services which would limit the beneficial opportunities possible (Michaels & McDermott, 2003; Puckett, 2004). Lee and Vega (2005) investigated how a teacher's attitude or acceptance level influenced the consideration process of assistive technology. The efficacy of assistive technology combined with the rapid explosion of assistive technology devices are barriers to effective use of assistive technology by a student with disabilities (Edyburn, 2003; Parette & Peterson-Karlan, 2007). When technology is not matched correctly to an individual, abandonment can occur; a student's opinion must be considered to reduce the chances of abandonment as a barrier (Beigel, 2000; Phillips & Zhao, 1993). The lack of motivation of an individual can also lead to abandonment (Parette & Scherer, 2004). Any benefits to a student with disabilities are restricted when assistive technology is abandoned.

Statement of the Problem

Many students with disabilities are struggling to achieve academic growth due to a variety of learning and behavioral challenges. In 2011, 12.7% of the student population

in Iowa was identified as eligible to receive special education services (Iowa Department of Education, 2011). While the law requires consideration of assistive technology devices and services for each student with a disability and the established benefits of assistive technology are clear, significant barriers in the consideration and implementation of assistive technology with students with disabilities remain.

The problems associated with the provision of assistive technology devices and services to students with disabilities were examined through two theoretical lenses. Rogers's Diffusion of Innovations Theory and Davis's Technology Acceptance Model provided a conceptual framework to examine how assistive technology devices and services are provided to students with disabilities.

Diffusion of Innovations Theoretical Framework

The Diffusion of Innovations model was first published in 1962 in a book by Everett M. Rogers (Rogers, 2003). Rogers completed a great deal of his research through Iowa State University with area farmers as his participants. Rogers (2003) was researching the rate of diffusion of agricultural innovations by observing Iowa farmers who delayed for several years in adopting new ideas that could have been profitable for them. Rogers defined diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5).

Elements Influencing the Diffusion of Innovation

Four main elements influence the spread of a new idea: innovation, communication channels, time, and the social system. Rogers defined an innovation as "an idea, practice or object that is perceived as new by an individual or another unit of

adoption" (2003, p. 12). He also stated that "An innovation presents an individual or an organization with a new alternative or alternatives, as well as new means of solving problems" (p. *xx*). According to Rogers, assistive technology would be an innovation for a teacher, as it provides a new alternative to solving a problem. A communication channel is defined by Rogers as "the means by which messages get from one individual to another" (p. 18). For example, for teachers of students with disabilities in a rural school, the element of communication may be a challenge. Rural school districts are often isolated and possibly only employ one special education teacher which does not allow for communication with a colleague in special education. Teachers, like all individuals, prefer to interact with other teachers who are similar in their beliefs or education. Rogers (2003) defined this as homophily. One way teachers learn about innovations is through professional development. School districts in general have been limiting the amount of professional development that occurs outside the school. When professional development is limited, it may lengthen the time between knowing about an innovation and its point of adoption, due to teachers not having access to information about the innovation. Rogers defined three components of time.

> The time dimension is involved in diffusion in (1) the innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection, (2) the innovativeness of an individual or other unit of adoption (that is, the relative earliness/lateness with which an innovation is adopted) compared with other members of a system, and (3) an innovation's rate of adoption in a system, usually measured as the number of members of the system who adopt the innovation in a given time period. (p. 20)

The fourth element of diffusion is the social system. This was defined by Rogers (2003) as "a set of interrelated units that are engaged in joint problem solving to

accomplish a common goal" (p. 23). These members or units may be "individuals, informal groups, organizations, and/or subsystems" (p. 23). Rogers stressed the structure of the social system in this statement. "The structure of the social system can facilitate or impede the diffusion of innovations" (p. 25). The social structure within a school is usually a top down model with the administrators making final decisions pertaining to suggestions of innovations by teachers. Therefore, if an administrator has a different level of the importance of assistive technology to students with disabilities the diffusion rate of assistive technology will be impeded. Rogers (2003) further claimed that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters.

According to Rogers, (2003), a teacher's consideration of assistive technology may be influenced by any or all of these four elements that influence the diffusion of a new innovation. The teacher may or may not be aware that the innovation itself can provide many benefits to students with disabilities or may have barriers to obtaining the innovation to be utilized by the individual with disabilities. The communication channels available to teachers are variable. A teacher that has a strong support system, including an assistive technology team or possibly a mentor or colleague with knowledge pertaining to assistive technology, will have the opportunity to diffuse assistive technology more effectively. Teachers who have the opportunity to access information through a viable communication channel will have an advantage to diffuse the innovation. Time is a critical element for all teachers and is usually not an element that teachers can control, given the demands placed upon teachers. Teachers have to invest a

great deal of their own time beyond the contracted hours to stay informed of assistive technology. The social structure surrounding a teacher will play a major role in the decision to adopt an innovation. Teachers who are surrounded by a culture of creativity and innovation will strive to look for various types of assistive technology to meet the needs of their students with disabilities. The social system is described as having innovation characteristics (Rogers, 2003).

Innovation Characteristics

The eventual acceptance of innovations by members of the social system depends primarily on five user-perceived innovation characteristics: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). Relative advantage is the degree to which an innovation is perceived as better than the idea or device that it supersedes. The higher the perceived relative advantage of an innovation, the more rapid its rate of adoption will be. The degree of relative advantage is usually expressed as economic profitability or as conveying social prestige (Rogers, 2003). Factors that teachers might compare include low initial cost; a decrease in comfort, social stigma or acceptance, and saving time and effort.

> Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An innovation that is compatible with the values and norms of the social system will be adopted more rapidly than an innovation that is not compatible. Teachers of students with disabilities consider the individuality of each of their students. Teachers will need to be able to understand the student and their family's values and past experiences during the adoption process. Students or families who have experienced a negative encounter with an assistive technology device or service will not adopt the innovation rapidly. (p. 15)

Complexity is the "degree to which an innovation is perceived as difficult to understand and use" (Rogers, 2003, p.16). Therefore, the simpler an idea is to understand by members of a social system, the more quickly it will be adopted. Assistive technology can be simple or very complex to utilize. This suggests teachers will need to explore the level of complexity of an assistive technology device or service as it pertains to how the student may use the device in all settings. The device will need to be easily transported between home and school, and if extraneous accessories are needed, they will have to be available in every setting.

Trialability is the "degree to which an innovation may be experimented with on a limited basis" (Rogers, 2003, p. 16). If a new idea can be adopted in stages before accepting the whole plan, it will be more quickly accepted. Teachers do not generally have high-tech assistive technology devices available to conduct a trial period. The high-tech devices are more expensive and therefore less available for a trial period. The IEP team will be reluctant to match a student with an assistive technology device without evidence of the device meeting the student's needs.

The fifth characteristic, observability, is the "degree to which the results of an innovation are visible to others. The easier it is for the individuals to see the results of an innovation, the more likely they are to adopt" (Rogers, 2003, p. 16). Assistive technology devices will be more readily accepted if another individual with disabilities is utilizing the device, and it is a positive experience for the individual. In order for an innovation to be adopted quickly, individuals must perceive it to have greater relative advantage, compatibility, trialability, and observability, and less complexity. Rogers

(2003) believed that the relative advantage of the innovations over traditional methods, and the compatibility of the innovations with personal values and social norms influence the prospective adopters the most.

Rogers (2003) described the innovation-decision process as

> The process through which an individual (or other decision-making unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. This process consists of a series of choices and actions over time through which an individual or a system evaluates a new idea and decides whether or not to incorporate the innovation into ongoing practice. This behavior consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to an idea previously in existence. (p. 168)

According to this theory, teachers might go through a process similar to this when obtaining assistive technology devices or services to meet the needs of their students with disabilities. A teacher's process may include considering what the cost or benefit of the device would be to the student, how the new device would be accepted by the parent or the student's peers, how difficult the device be to use, whether additional training would be needed, and whether the device would be useful in all settings. A teacher also needs to know whether the device is available for a trial period, where to obtain the device, and where to observe the device as it is being used. According to Rogers (2003), the perception of these characteristics of the innovation will influence the rate of adoption.

Innovation decision process

Diffusion scholars recognize that an individual's decision about an innovation is not an instantaneous act, but rather a process. For Rogers (2003), the innovation-decision process involves five stages: (1) knowledge, (2) persuasion, (3) decision, (4)

implementation, and (5) confirmation. The innovation-decision process is defined by Rogers as "an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (p. 172).

In the knowledge stage, an individual learns about the existence of innovation and attempts to gain some understanding of it. During this stage the "individual wants to know what the innovation is and how and why it works" (Rogers, 2003, p. 21). The individual is just becoming aware of the innovation, and they are seeking basic information to begin to reduce the level of uncertainty about the ability of the innovation to solve a problem (2003). The communication channel in the knowledge stage is usually mass media.

The persuasion stage occurs when an individual has formed a negative or positive attitude toward the innovation, but "the formation of a favorable or unfavorable attitude toward an innovation does not always lead directly or indirectly to an adoption or rejection" (Rogers, 2003, p. 176). During the persuasion stage, an individual wants to know the advantages or disadvantages of the innovation as it is used in his situation. The communication channel is now an interpersonal communication network because the mass media information is too general. Rogers (2003) made a distinction between the knowledge and persuasion stage as, "the mental activity at the knowledge stage was mainly cognitive (or knowing), the main type of thinking at the persuasion stage is affective (or feeling)" (p. 175).

In the decision stage, an individual "engages in activities that lead to a choice to adopt or reject an innovation" (Rogers, 2003, p. 177). Rogers stated that during the persuasion and decision stages "an individual seeks innovation evaluation information, messages that reduce uncertainty about an innovation's expected consequences" (p. 175). Individuals prefer to conduct a trial period of an innovation during the decision stage. The relative advantage of the innovation is considered during this stage. If the innovation proves to have at least a certain degree of relative advantage, a choice is made to adopt and proceed to the implementation stage (2003). Rejection of the innovation occurs in the absence of relative advantage.

At the implementation stage, an innovation is put into practice. At this stage the innovation-decision process changes from a mental exercise of thinking and deciding to a behavior change of putting the new idea into practice (Rogers, 2003). An individual still has a certain degree of uncertainty about the expected consequences of the innovations (2003). Teachers in this stage might question where they can obtain the assistive technology device, what they need to know to set it up, and how to implement the device to yield the most benefit. Even though the decision was made to implement, the questions will continue.

During the confirmation stage, an individual seeks reinforcement for the innovation-decision already made and strives to avoid a state of dissonance. Rogers (2003) defined dissonance as "an uncomfortable state of mind that an individual seeks to reduce or eliminate" (p. 189). If the individual experiences dissonance, they may reverse their innovation-decision already made. Moving through the five stages is described as

recursive rather than linear as individuals may reject an innovation at one point in the process but choose to adopt later. An individual in a social system makes decisions to adopt or reject at various times.

According to this theory, a teacher's decision making process for considering assistive technology may represent a recursive process in which a teacher progresses through the knowledge stage of finding about an assistive technology device into the persuasion stage where the teacher collects more information and forms an opinion regarding the device. The teacher can reject the innovation at this point or choose to proceed through the entire process. Rogers (2003) suggested teachers might go through this innovation-decision process as they consider assistive technology to meet the needs of a student with disabilities.

Adopter Categories

Rogers (2003) recognized that individuals in a social system do not all adopt an innovation at the same time, which allowed him to classify individuals into adopter categories. These categories were based on when the individual first began to use a new idea. Rogers (2003) defined innovativeness as "the degree to which an individual (or other unit of adoption) is relatively earlier in adopting new ideas than other members of a system" (p. 267). The five adopter categories are innovators, early adopters, early majority, late majority, and laggards.

Innovators are venturesome almost to the point of obsession. The innovator must be able to "cope with a high degree of uncertainty about an innovation at the time he or she adopts" (Rogers, 2003, p. 282). Other prerequisites of an innovator include

substantial financial resources to absorb possible losses and the "ability to understand and apply complex technical knowledge" (p. 282). The innovator launches the new idea in the system by importing the innovation from outside of the system's boundaries, which is an important part in the diffusion process.

According to Rogers (2003), "early adopters are a more integrated part of the local social system than innovators" (p. 283) and are the respected leaders in the social system. Early adopters serve as role models and help to "trigger the critical mass when they adopt an innovation" (p. 283). Rogers (2003) stated "The early adopter decreases uncertainty about a new idea by adopting it, and then conveying a subjective evaluation of the innovation to near peers through interpersonal networks" (p. 283).

The early majority group has a unique location between the "very early and the relatively late to adopt which makes them an important link in the diffusion process" (Rogers, 2003, p. 284). The individuals in the early majority group seldom hold leadership positions in a system, but they do interact frequently with their peers. Rogers (2003) labeled this group as "they follow with deliberate willingness in adopting innovations but seldom lead" (p. 284).

The late majority tend to adopt new ideas very soon after the average member of a social system (Rogers, 2003). The late majority and early majority each make up one third of the members of a social system. Adoption for individuals in the late majority category may be due to peer pressure or economic necessity and is usually approached with skepticism and caution. Rogers (2003) explained this as "their relatively scarce

resources mean that most of the uncertainty about a new idea must be removed before the late majority feel that it is safe to adopt" (p. 284).

Laggards are the last individuals in a social system to adopt an innovation (Rogers, 2003). Individuals in the laggard category tend to be suspicious of innovations or change in general and their point of reference is what has happened in the past. Laggards' resources impact the adoption rate as their "precarious economic position forces the individual to be extremely cautious in adopting innovations" (p. 285).

Rogers (2003) identified a dominant attribute for each category of the adopters on the innovativeness continuum."Innovators – venturesome; early adopters – respect; early majority – deliberate; later majority – skeptical; and laggards – traditional" (p. 298). These standard five adopter categories are widely accepted in diffusion research.

According to this theory, a teacher's consideration of assistive technology may be characterized by when they first began to utilize an idea or innovation. Are teachers free to be innovators or early adopters, or are they forced to stay in the early majority or later majority categories due to fiscal restraints or a teacher's knowledge level? In this study, Rogers's theory provided a lens through which to look regarding the process and resources teachers utilize to provide assistive technology to their students with disabilities.

Adoption of the Theoretical Model for the Research Endeavor

Rogers's Diffusion of Innovation theory was useful as it posed some questions to consider in addressing the problems associated with the diffusion of assistive technology. Rogers's (2003) definition of diffusion contains the four elements: innovation,

communication channels, time, and the social system. Is a teacher's consideration of assistive technology devices and services influenced by communication channels, time, and the social system? For example, are communication channels insufficient in informing teachers of the assistive technology that is available? Do teachers have time to explore or stay abreast of the rapidly changing assistive technology field? If teachers have adequate communication channels and are provided time to gain knowledge, will the social system within the school system and the family be accepting of the assistive technology?

The way people in a social system perceive the five attributes of an innovation determines its rate of adoption (Rogers, 2003). The five attributes are relative advantage, compatibility, complexity, trialability, and observability. Does a teacher's perception of relative advantage, compatibility, complexity, trialability, and observability influence the process of considering assistive technology for students with disabilities? Is complexity a challenge encountered by teachers adopting and implementing assistive technology? Are teachers able to obtain the high-tech devices to conduct a trial?

Rogers (2003) outlined the innovation-process stages to include knowledge, persuasion, decision, implementation, and confirmation. Will this be the same process that teachers utilize for the consideration of assistive technology? What are a teacher's resources to obtain decision-making knowledge pertaining to the adoption or rejection of assistive technology? Do teachers follow these steps or different steps to move through the innovation-process stage?

Five categories of adopters are identified as innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). Do teachers represent different categories of assistive technology adopters based on the time of adoption? Will teachers imply they are laggards due to precarious economic conditions? Will teachers view themselves as innovators, or do others higher in the social system stifle this category?

Rogers's theory of Diffusion of Innovations (2003) identified the critical components of adopting an innovation. Teachers are continually directed to adopt new innovations as they strive to best meet the needs of their students. Rogers's model provided a useful lens to examine the process teachers utilize to obtain or consider assistive technology devices or services to meet the needs of their students with disabilities. Rogers's model stimulated a variety of questions and was a useful construct in examining the research questions for this study.

Technology Acceptance Model Theoretical Framework

The Technology Acceptance Model (TAM) is based on Fishbein and Ajzen's (1975) attitude paradigm from psychology, the Theory of Reasoned Action (TRA). TRA was derived from previous research that started as the theory of attitude and led into the study of attitude and behavior. This paradigm specifies how to measure the behavior-relevant components of attitude, distinguishes between beliefs and attitudes, and specifies how external stimuli are causally linked to beliefs, attitudes, and behavior (Fishbein & Ajzen, 1975, as cited in Davis, 1993). TRA was very general, and therefore useful, to explain any human behavior (Davis, Bagozzi, & Warshaw, 1989).

The TAM has a strong behavioral element and assumes that when someone forms an intention to act, they will be free to act without limitation. In actuality, these limitations are external and include constraints such as limited ability, time, and environmental or organizational structures which could limit the freedom to act. External factors pertaining to teachers who utilized assistive technology in this study included the lack of time and a teacher's limited knowledge pertaining to assistive technology due to limited previous training or ongoing training pertaining to assistive technology. These external factors may all be limits to teachers' considerations of assistive technology for students with disabilities.

TAM replaced many of TRA's attitude measures with just two technology acceptance measures; perceived ease of use and perceived usefulness. The goal of TAM was to provide an "explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and use populations, while at the same time being both parsimonious and theoretically justified" (Davis et al., 1989, p. 985). An ideal model would be one "that is helpful not only for prediction but also for explanation" (p. 985) so practitioners could identify why a system may be unacceptable and take necessary corrective steps. "A key purpose of TAM, therefore, is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions" (p. 985).

Davis (1986) had two objectives in mind when he introduced the Technology Acceptance Model (TAM):

> First, it should improve our understanding of user acceptance processes, providing new theoretical insights into the successful design and implementation

> of information systems. Second, TAM should provide the theoretical basis for a practical 'user acceptance testing' methodology that would enable system designers and implementers to evaluate proposed new systems prior to their implementation (p. 7).

Davis (1986) hypothesized that there is an" intervening motivational response on the part of the user. Namely, the characteristics of the system affect how motivated users are to use the system, which in turn affects their own actual system use or non-use" (p. 11). User acceptance is often the critical factor determining the success or failure of an information system project. The choice toward using is a "function of two beliefs: perceived usefulness and perceived ease of use. Perceived ease of use has a causal effect on perceived usefulness" (Davis, 1993, p. 478). Davis (1986) defined perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (p. 26). Perceived usefulness relates to job effectiveness, productivity, and job importance. He also defined perceived ease of use (PEU) as "the degree to which an individual believes that using a particular system would be free of physical and mental effort," (p. 26) in terms of physical and mental effort as well as ease of learning. Perceived ease of use is hypothesized to have a significant direct effect on perceived usefulness, since all else being equal, a system which is easier to use will result in increased job performance (i.e., greater usefulness) for the user" (p. 26).

Using Davis's theories, it could be suggested that a person using a piece of assistive technology for the first time would form an opinion (perceived ease of use) about whether using the device would be free of physical and mental efforts. From this PEU the perceived usefulness could be predicted if the person would use the device.

Davis supported this suggestion by saying that perceived ease has a direct effect on perceived usefulness. If a student with writing difficulties was shown a ping pong ball with a pencil through it, a low-tech pencil grip, and a large pencil with a Velcro strap that attaches around the student's wrist and then to a slant board, which one would the student pick? Applying Davis's TAM, the student would pick the ping pong ball, which has a higher perceived ease of use, which in turn would have a positive direct effect on perceived usefulness. Applying Davis's TAM to teachers of students with disabilities, an assumption could be made that a teacher would pick the assistive technology device that appears to be easier to use, free of physical and mental effort, which would have a positive direct effect on perceived usefulness. This may influence how quickly teachers utilize assistive technology to meet the needs of their students with disabilities.

Davis's Technology Acceptance Model has been studied and tested many times since its inception (Davis, et al., 1989). TAM has proven beneficial for practitioners to be able to predict whether the new system will be acceptable to users and to make changes if the planned system is not fully acceptable to users. Davis's findings relate to perceived assistive technology acceptance by students with disabilities. Based on Davis's Technology Acceptance Model, a teacher's consideration of assistive technology devices and services may be influenced by perceived ease of use and perceived usefulness. Davis (1993) assumed that when a person forms an intention to act, they will be free to act without limitations. In a school, teachers face limitations daily. Teachers may have a large number of students, shortage of time, limited resources, or a lack of previous training or ongoing training of assistive technology. These limitations could impact a

teacher's acceptance level of assistive technology by influencing the perceived ease of use or perceived usefulness. Does a teacher feel these limitations when making decisions about assistive technology? Does a teacher solicit perspectives from students regarding the perceived ease of use and usefulness when considering assistive technology supports? The use of the Technology Acceptance Model will provide an interesting perspective when applied to responses of participants in this study.

Teachers need to continually process knowledge about assistive technology: how it works, how it affects the performance of a student, and how it will match with the environment of the school. Teachers need to investigate all the legal components of assistive technology, the benefits and barriers of assistive technology, as well as the ongoing explosion of assistive technology devices.

Comparison of Theoretical Frameworks

Rogers's theory on Diffusion of Innovation and Davis's Technology Acceptance Model both focus on the adoption of a product. The Diffusion of Innovation and the Technology Acceptance Model can be applied to a variety of environments. Both models were useful in explaining the problems associated with the provision of assistive technology devices and services to students with disabilities.

Rogers's model contains four elements: innovation, communication channels, time, and the social system. How the five attributes—innovation, relative advantage, compatibility, complexity, trialability, and observability—are perceived in the social system is what determines the rate of adoption. Davis's model is based on the perceived

ease of use and the perceived use of a system. A common element of both of the models is the steps in the process of change and the influences of numerous variables.

Rogers's concepts and Davis's model resemble each other in the belief that a person knows about an innovation for some time before exploring it further. In Rogers's case, exploring it further would consist of making a decision to adopt or reject, in Davis's case, it would consist of calculating perceived ease of use and perceived usefulness of the innovation.

Applying both of these models to assistive technology helped to examine the factors and processes involved in a teacher's consideration of assistive technology devices and services. Research was conducted to determine what level of adopter the participants viewed themselves as, whether the perceived ease of use or perceived usefulness had an impact on the adoption of assistive technology, and which process teachers feel they have to navigate to provide assistive technology to their students.

In consideration of theoretical frameworks for this study, Rogers's and Davis's models provided a detailed lens to attempt to understand the experiences of the participants of this study. Rogers's and Davis's models provided the theoretical basis for examining the following research questions

Research Questions

1. How do teachers of students with disabilities characterize the process of obtaining assistive technology devices or services to meet the needs of their students with disabilities?

2. What factors influence the process of adopting and utilizing assistive technology to meet the needs of their students?

3. What resources and challenges do teachers of students with disabilities encounter in considering, adopting, and utilizing assistive technology to meet the needs of their students?

Purpose of the Study

The purpose of this qualitative study was to discover the processes and factors that teachers of students with disabilities use in considering, adopting, and utilizing assistive technology to meet the needs of their students. This qualitative study was conducted through interviews with three elementary special education teachers in a small rural school in the Midwest. The interviews were conducted in an attempt to capture the story of the resources and challenges that teachers encounter as they consider, adopt, and utilize assistive technology to meet the needs of their students. For most people, technology makes life easier or broadens their horizons, but for students with disabilities, assistive technology may provide the opportunity to increase independent functioning and access the general education curriculum. All students have the right to these opportunities.

Significance of the Study

Based on interviews with teachers of students with disabilities in a small rural school, this study contributes to a better understanding of how teachers perceived the process of obtaining assistive technology devices or services. Did teachers view themselves as early adopters or laggards, or did they recognize the external and internal

factors that may influence their decision making process? Were teachers able to overcome the barriers in order to provide the most appropriate assistive technology device or service for a student with a disability? Did teachers demonstrate a perceived usefulness of the assistive technology device and did this enhance the process of matching the appropriate assistive technology device or service to the student with disabilities? It is hoped that by developing a better understanding of the process of considering assistive technology and the resources and challenges teachers encounter in this process, the proper resources can be identified and possibly a solution to provide these resources can be identified.

This study was significant as it added to the body of knowledge to aid in understanding and becoming aware of the benefits and barriers as they pertain to assistive technology. By identifying these benefits and barriers, a better perception can be obtained to determine why assistive technology devices and services are not more prevalent in schools.

Summary

This chapter presented the legal requirements, a brief description of what assistive technology is, and the benefits and the barriers of assistive technology as a background. The purpose of this study was to discover the processes and factors that teachers of students with disabilities use in adopting and utilizing assistive technology. This study was significant as it added to the body of knowledge to aid in understanding and becoming aware of the benefits and barriers as they pertain to assistive technology. Three research questions guided the study. Along with these components, two theoretical

frameworks were presented to guide the researcher with a lens to view the process teachers maneuver through while considering assistive technology and the resources and challenges encountered in this process.

Assistive technology has become an important tool in the education of students with disabilities (Thompson, Siegel, & Kouzoukas, 2000). Chapter 2 is a literature review of legislation pertaining to assistive technology, definitions and examples of assistive technology, the benefits of assistive technology and the barriers of assistive technology. This review illustrated the multiple federal initiatives involved in assistive technology, definitions and descriptions of assistive technology, and a continuum of assistive technology. The chapter included a discussion of benefits— including access to learning, social interaction, and self-management benefits—and barriers—including fiscal restraints, teachers, equipment and abandonment of assistive technology.

CHAPTER 2

REVIEW OF LITERATURE

Several cognate areas of literature were reviewed for this study. Of particular interest was the federal initiative involving the provisions of assistive technology devices and services as well as the benefits and barriers of assistive technology. A variety of databases were accessed to compile a comprehensive review of literature. The first section of this literature review is a brief discussion of legislation as it pertains to assistive technology. The second section defines and describes assistive technology and provides examples of devices on the assistive technology continuum. The third section presents the benefits of assistive technology for students with disabilities, while the fourth section of the literature review outlines the barriers to assistive technology supports for these children.

Legislation

Legislation enacted in the last 25 years has stimulated technology applications in special education and improved the legal rights of students with disabilities in a variety of ways. "This stimulation has been in the form of federal laws and regulations that have included technology mandates and funding to support a wide variety of technology research and development, training, and service activities" (Blackhurst, 2005a, p. 3). Assistive technology was inserted into federal legislation with the objective of giving students with disabilities increased access to the general education curriculum (Edyburn, 2000a).

Marino, Marino, and Shaw (2006) outlined four major pieces of legislation they considered pertinent to assistive technology: The Technology Related Assistance for Individuals with Disabilities Act of 1988, The Americans with Disabilities Act of 1990, The 1998 Amendment to Section 508 of the Rehabilitation Act, and The Assistive Technology Act of 1998. In this section the literature pertinent to the legislative acts deemed important by Marino et al. (2006) is reviewed, but will also include: The Technology-Related Assistance for Individuals With Disabilities Act Amendments of 1994, the Education for All Handicapped Children Act, the Individuals with Disabilities Act Amendments of 1997, and the Individuals with Disabilities Education Improvement Act of 2004 which required assistive technology to be considered in the educational programs of students with disabilities.

Technology Related Assistance for Individuals with Disabilities Act of 1988

Assistive technology was first introduced into federal law in The Technology-Related Assistance for Individuals with Disabilities Act of 1988, the Tech Act. Assistive technology is now incorporated into every piece of federal legislation for persons with disabilities. This act has been touted as one of the most influential and potentially beneficial laws which "supports the development of programs that will ensure access to appropriate assistive technology devices and services for individuals with disabilities and their families" (Bryant et al., 1998, p. 55). This act was "the first substantive federal legislation dedicated solely to AT" (Marino et al., 2006, p. 19).

The Tech Act was passed by Congress "to provide funding for the development of consumer information and training programs for individuals with disabilities. The Tech

Act outlined two types of assistive technology – devices and services" (Dyal, Carpenter, & Wright, 2009, p. 557). The Tech Act was "designed to enhance the availability and quality of assistive technology (AT) devices and services to all individuals and their families throughout the United States" (Behrmann & Jerome, 2002).

"The term 'assistive technology device' means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" [29 U.S.C. § 2202(1)]. The Tech Act includes the definition of an assistive technology service:

> (4) Assistive technology service.--The term ``assistive technology service" means any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes—
> (A) the evaluation of the assistive technology needs of an individual with a disability, including a functional evaluation of the impact of the provision of appropriate assistive technology and appropriate services to the individual in the customary environment of the individual;
> (B) services consisting of purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by individuals with disabilities;
> (C) services consisting of selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices;
> (D) coordination and use of necessary therapies, interventions, or services with assistive technology devices, such as therapies, interventions, or services associated with education and rehabilitation plans and programs;
> (E) training or technical assistance for an individual with disabilities, or, where appropriate, the family members, guardians, advocates, or authorized representatives of such an individual; and (F) training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to employ or are otherwise substantially involved in the major life functions of individuals with disabilities. [29 U.S.C. § 2202(3)(2)]

However, this act did not establish any standards for the delivery of assistive technology services or standards to the providers of these services. The Tech Act

provided federal funds to states to develop training and delivery systems for assistive technology devices and services. These funds were in the form of grants to develop consumer information and training programs to meet the needs of students with disabilities. Each state was required to develop a plan including technology- related services for students with disabilities and provide definitions to delineate assistive technology devices and services.

Bryant and Seay (1998) recognized the significance of the Tech Act. "Congress acknowledged AT's potential for assisting persons with disabilities to access the 'American dream' when it passed into law in 1988 the Technology-Related Assistance for Individuals with Disabilities Act" (p. 4).

Americans with Disabilities Act of 1990

The Americans with Disabilities Act (ADA) was signed into law in 1990 and its intent was to "provide clear, strong, consistent, enforceable standards addressing discrimination against individuals with disabilities" (Americans With Disabilities Act, 1990). Prior to ADA, any entity doing business with the federal government was required to meet the accessibility standards specified by previously enacted laws. The ADA extended "accommodations for individuals with disabilities beyond the federal government to the public and private sector" (Mondak, 2000, p. 45). These accommodations, as defined by Mondak, were "made to allow the individual to access needed facilities; equipment; technology such as computers, telecommunications, audiovisual equipment, and programs; or other communication systems in the office that are the same as those used by individuals without a disability" (p. 45). Assistive

technology devices and services are compatible with Mondak's definition of an accommodation and can be critical in achieving provisions of ADA by promoting access.

The ADA extended "full civil rights and equal opportunities to people with disabilities in both the public and private sectors" (Bailey, 2000, p. 2). The ADA, a civil rights statute, prohibited "discrimination on the basis of a physical or mental disability in employment, public services, public accommodations, and telecommunications" (p. 2). ADA's message maintained that intentional segregation and exclusion of people with disabilities would no longer be accepted (Day & Edwards, 1996). The ADA did not specifically address assistive technology, but it did extend civil rights protections to students with disabilities.

Marino et al. (2006) believed the ADA significantly impacted assistive technology consideration for students with disabilities. ADA stipulated that students with disabilities "be given equal access to public education, employment, transportation, recreation, and health care" (p. 19). Public Accommodations as outlined by ADA extended to places of education including public schools, elementary and secondary private schools, and day care programs. Practically every school district and post-secondary school in the United States is subject to ADA and Section 504 of the Rehabilitation Act of 1975 (Section 504) requirements (Smith, 2001). Section 504 applies to "entities that receive federal funds and the ADA apply to virtually every entity in the country except churches and private clubs. Schools that receive federal funds must comply with both Section 504 and the ADA" (p. 343).

Though the ADA required right of entry to education settings, access to materials inside those settings also proved challenging. An individual's access to educational content within a classroom setting without barriers of accessibility was one of the system changes mandated in The Technology-Related Assistance for Individuals with Disabilities Act Amendments of 1994.

Technology Related Assistance for Individuals with Disabilities Act Amendments of 1994

The focus of Technology-Related Assistance for Individuals with Disabilities Act Amendments of 1994 (The Tech Act of 1994) was to recognize the individual's need for assistive technology to succeed in school rather than the previous medical model (Alper & Raharinirina, 2006). The Tech Act of 1994 concentrated the states' activities on "the coordination of activities among state agencies, the development and implementation of strategies to empower individuals with disabilities, the increase of outreach to underrepresented populations and the creation of strategies to ensure timely acquisition of AT" (Noble, 2002, p. 51).

Specifically, in 1994, the Tech Act was amended to require each state to perform six specific systems-change and advocacy activities. The six mandated priority activities were:

> (i) The development, implementation, and monitoring of state, regional, and local laws, regulations, policies, practices, procedures, and organizational structures, that will improve access to, provision of, funding for, and timely acquisition and delivery of, assistive technology devices and assistive technology services; (ii) the development and implementation of strategies to overcome barriers regarding access to , provision of, and funding for such devices and services with priority for identification of barriers to funding through state education (including special education) services, vocational rehabilitation services, and medical assistance

> services or, as appropriate, other health and human services with particular emphasis on overcoming barriers for underrepresented populations and rural populations; (iii) coordination of activities among state agencies, in or to facilitate access to provision of and funding for assistive technology devices and assistive technology services; (iv) the development and implementation of strategies to empower individuals with disabilities and their family members, guardians, advocates, and authorized representatives, to successfully advocate for increased access to, funding for, and provision of, assistive technology devices and assistive technology services, and to increase the participation, choice, and control of such individuals with disabilities and their family members, guardians, advocates, and authorized representatives, in the selection and procurement of assistive technology devices and assistive technology services; (v) the provision of outreach to underrepresented populations and rural populations, including identifying and assessing the needs of such populations, providing activities to increase the accessibility of services to such populations, training representatives of such populations to become service providers, and training staff of the consumer-responsive comprehensive statewide program of technology-related assistance to work with such populations; and (vi) the development and implementation of strategies to ensure timely acquisition and delivery of assistive technology devices and assistive technology services, particularly for children, unless the State demonstrates through the progress reports required under section 104 that significant progress has been made in the development and implementation of a consumer-responsive comprehensive statewide program of technology-related assistance, and that other systems change and advocacy activities will increase the likelihood that the program will accomplish the purposes described in section 2(b)(1). [29 U.S.C. § 2212(e)(7)(B)

The first activity reflected Congress's disapproval of the current assistive technology delivery system (Bryant & Seay, 1998). The mission of the first activity was to "change the current system to better enable people with disabilities to access and use assistive technology devices and services" (p.6). The second activity placed state projects in the role of change agents regarding funding. This activity reinforced the mission of the first activity to change the current system and focused on the "state and federal funding policies that serve as barriers to the acquisition and use of assistive

technology devices and services" (p. 7). In the third activity, Congress pushed for state projects to increase their interagency collaboration efforts. This push was designed to better coordinate state's activities to reduce the consumer's confusion regarding the "most efficient manner to access funds for the purchase of an assistive technology device" (p. 7). The fourth activity addressed the need for individuals with disabilities to be better self-advocates. The fifth activity focused on "working with groups that are traditionally identified as underrepresented or rural" (p.10). The sixth activity addressed the need for "an efficient system of assistive technology service delivery that provides devices and services in a timely manner" (p. 10). This activity was that "state projects will provide subcontracts to protection and advocacy (P&A) systems to engage in litigation activities that will have a dramatic impact on the way states deliver assistive technology services" (p.11). This activity has led to an increase in the number of court cases involving access to assistive technology devices and services.

One additional main point in the 1994 amendments was "a sunset provision indicating that federal funding would begin to decrease in the final three years of the program and would be eliminated at the end of 10 full years of funding" (Bausch, Mittler, Hasselbring, & Cross, 2005, p. 61). The intent was for states to assume the fiscal responsibility when federal funding ceased.

While the Tech Act of 1988 provided funds to states to develop an effective assistive technology service delivery system, its subsequent reauthorization in 1994, "mandated that state Tech Act projects identify and eliminate systemic barriers that impede the timely acquisition and use of assistive technology devices and services"

(Bryant & Seay, 1998, p. 11). Because children and adults with disabilities can "benefit from assistive technology devices and services in school and in the workplace, it is critical that barriers to AT access be eliminated" (p.11). The Tech Act state projects work on behalf of all individuals with disabilities and have provided numerous programs and services to help people with disabilities access and use assistive technology devices.

The 1998 Amendment to Section 508

Beginning in 1973, federal legislation granted students with disabilities "basic civil rights mandating access to buildings, services, and schooling through Section 504 of the Rehabilitation Act of 1998" (Caverly & Fitzgibbons, 2007, p. 38). These rights were expanded, requiring access to electronic and information technology through the 1998 Amendments to Section 508 (Section 508) (2007) "The intention of Section 508 was to ensure that individuals with disabilities could access electronic information (databases, applications) and manipulate the data and related information" (Mondak, 2000, p. 44). This legislation set a standard for all government created electronic information including websites to be accessible by persons with disabilities:

> individuals with disabilities who are members of the public seeking information or services from a Federal department or agency to have access to and use of information and data that is comparable to the access to and use of the information and data by such members of the public who are not individuals with disabilities. [29 U.S.C. § 508(a)(1)(A)(ii)]

The 1998 Amendment to Section 508 of the Rehabilitation Act "required that all electronic or information technology that is developed, procured, maintained, or used by the federal government be accessible to individuals with disabilities, unless an undue burden would be imposed on the agency" (Marino et al., 2006, p.19). Section 508

required that all Federal information that is accessible electronically must be accessible to individuals with disabilities in a variety of ways, which are specific to each disability. This amendment was in response to the growth of electronic and information technologies that were emerging for the general public.

Assistive Technology Act of 1998

The Tech Act of 1994 was repealed and replaced with the Assistive Technology Act of 1998 (hereinafter 1998 AT Act). The purposes of the 1998 AT Act were

> (1) to provide financial assistance to states to undertake activities that assist each state in maintaining and strengthening a permanent comprehensive State-wide program of technology-related assistance, for individuals with disabilities of all ages, that is designed to . . . . (2) to identify Federal policies that facilitate payment for assistive technology devices and assistive technology services, to identify those Federal policies that impede such payment, and to eliminate inappropriate barriers to such payment; and (3) to enhance the ability of the Federal Government to . . . . [29 U.S.C. § 3001(b)(1)(2)(3)]

With the 1998 AT Act "Congress shifted the focus from defining and acquiring assistive technology devices and services to providing assistive technology for access to the general education curriculum for students with disabilities" (Dyal et al., 2009, p. 557). The 1998 AT Act continued to support capacity building and advocacy activities through grants and encouraged research of the principles of Universal Design for Learning (UDL) related to assistive technology to address the technological needs of students with disabilities (Beard, Carpenter, & Johnston, 2011). The 1998 AT Act provided funds to states to support three types of programs:

> The establishment of assistive technology (AT) demonstration centers, information centers, equipment loan facilities, referral services, and other consumer-oriented programs; (2) protection and advocacy services to help people with disabilities and their families, as they attempt to access the services for which they are eligible; and (3) Federal/state programs to provide low interest

> loans and other alternative financing options to help people with disabilities purchase needed assistive technology ("Assistive Technology Laws", n.d.).

The goal of the 1998 AT Act was to increase access to assistive technology devices and services for individuals of all ages and across all disabilities (Bailey, Meidenbauer, Fein, & Mollica, 2005). Under the 1998 AT Act, "state AT Act projects must focus on achieving progress in five goal areas: employment, health care, community living, education, and telecommunications/information technology" (p. 31).

Assistive Technology Act of 2004

The Assistive Technology Act of 1998 was reauthorized and entitled Assistive Technology Act of 2004 (hereinafter 2004 AT Act).The 2004 AT Act did not include a sunset provision. "This means that state programs can expect funding through the life of the bill assuming funds are appropriated, as is the case of most government programs" (p. 61). With this removal, a more reliable stream of funding was identified which also allowed for longer-term planning of projects and the ability to hire qualified individuals.

The 2004 AT Act continued the tradition of setting goals to increase the availability of funding for access to, provision of, and training about assistive technology devices and services. Bausch et al. (2005) summarized the additional goals of the 2004 AT Act:

> (a) increase the use of AT in the transition from one program to another, (b) increase the involvement of individuals and their families in the decision making process, (c) increase the capacity of public agencies to provide and pay for AT, (d) increase coordination among agencies, (e) facilitate the change in AT laws and policies, and (f) increase awareness and knowledge of the benefits of AT. (p. 61)

Another major change brought about by the 2004 AT Act was a change in purpose. Previous Acts focused on helping states build "systems for improving access to assistive technology devices for individuals with disabilities" (Boehner, 2004). Under the Assistive Technology Act of 2004, states would be required to use a majority of federal funds to directly help individuals, switching the primary purpose from establishing systems to directly helping the individuals with disabilities that need assistive technology devices:

> Increase awareness and knowledge of the benefits of assistive technology devices and assistive technology services among targeted individuals and entities and the general population; and (2) to provide States with financial assistance that supports programs designed to maximize the ability of individuals with disabilities and their family members, guardians, advocates, and authorized representatives to obtain assistive technology devices and assistive technology services. [29 U.S.C. § 3001(8)(b)(1)(G)(2)]

"Although school-age children with disabilities....will continue to receive the bulk of their services from IDEA, which mandates that all students with an IEP must be considered for AT, the AT Act will also have several implications for students" (Bausch et al., 2005, p. 64). The state-run awareness and information activities are anticipated to increase awareness of assistive technology which will improve the likelihood that students will receive the assistive technology devices and services they need. Additional components of AT Act include device reutilization, device demonstration, and device loan programs at the state level which should provide additional benefits to parents, teachers, administrators, and students with disabilities.

The definition of an individual with a disability was modified to include people of all ages. The 2004 AT Act defines eligibility as:

> (A) Individual with a disability. –The term "individual with a disability' means any individual of any age, race, or ethnicity—(i) who has a disability; and (ii) who is or would be enabled by an assistive technology device or an assistive technology service to minimize deterioration in functioning, to maintain a level of functioning, or to achieve a greater level of functioning in any major life activity. [29 U.S.C. § 3001(10)(A)(i)(ii)]

By expanding the definition of eligibility, the 2004 AT Act can be "assumed to assist many of the 54 million individuals currently identified with a disability" (Bausch et al., 2005, p. 59). Overall, the 2004 AT Act provided a more optimistic future for assistive technology.

All the Tech Act laws have been a major force in helping children and adults with disabilities live more productive and independent lives in their schools, workplaces, neighborhoods, and communities. The Tech Act first defined assistive technology devices and services; however, it was the Individuals with Disabilities Education Act (IDEA) that outlined the school district's responsibility to provide assistive technology to students with disabilities.

EAHCA and IDEA 1990

Public Law 94-142, the Education for All Handicapped Children Act (EAHCA) was amended and the name changed to Individuals with Disabilities Education Act [IDEA], (1990; Etscheidt & Bartlett, 1999). The primary purpose of both statutes is to "ensure that a free and appropriate public education (FAPE) is provided to children with disabilities who have been determined to need specially designed instruction" (Reed and

Bowser, 2005, p. 61). A Free Appropriate Public Education (FAPE) is what all children in the United States are entitled to under IDEA.

IDEA 1990 "created a detailed set of guidelines to ensure an appropriate education in the least restrictive setting" (Yell & Katsiyannis, 2004, p. 28) for students with disabilities. In order to be provided with a free appropriate public education, children with disabilities may be placed in several different types of educational settings. The least restrictive of these settings is the general education environment because this is the "placement in which there is the greatest measure of opportunity for proximity and communication with the ordinary flow of students in schools" (p. 30).

IDEA (1990) defined "assistive technology for the first time, using a broad interpretation consistent with previous legislation" (Parette & VanBiervliet, 1991). This definition, which has been retained in IDEA is "any item, piece of equipment, or product system, whether acquired commercially or off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities" (20 U.S.C. §1401(a)(25); 34 C.F.R. §300.5). IDEA 1990 defined an assistive technology service as:

> Any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes - - (A) the evaluation of the needs of an individual with a disability, including a functional evaluation of the individual in the individual's customary environment (20 U.S.C. § 1401(2)(A)

Including these definitions in IDEA increased access to assistive technology devices and services for children with disabilities and reinforced the provision of assistive technology as a means for a free and appropriate public education (Bailey et al., 2005).

Two of the general principles of IDEA 1990 were Free Appropriate Public Education (FAPE) and Least Restrictive Environment (LRE).

> Free appropriate public education, or FAPE, means special education and related services that-- (a) Are provided at public expense, under public supervision and direction, and without charge; (b) Meet the standards of the SEA, including the requirements of this part; (c) Include an appropriate preschool, elementary school, or secondary school education in the State involved; and (d) Are provided in conformity with an individualized education program (IEP) that meets the requirements of Sec. 300.320 through 300.324. (34 C.F.R. § 300.17) (Authority: 20 U.S.C. 1401(9))
> Least Restrictive Environment, or LRE, requirements are
> (1) Except as provided in Sec. 300.324(d)(2) (regarding children with disabilities in adult prisons), the State must have in effect policies and procedures to ensure that public agencies in the State meet the LRE requirements of this section and Sec. Sec. 300.115 through 300.120, and
> (2) Each public agency must ensure that-- (i) To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are nondisabled; and (ii) Special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occurs only if the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily.
> (34 C.F.R. § 300.114) (Authority: 20 U.S.C. 1412(a)(5))

IDEA 1990 required schools to provide assistive technology services and equipment for a student with a disability if it was necessary to ensure a free and appropriate public education (Merbler, Hadadian, & Ulman, 1999). IDEA 97 extended this mandate by requiring IEP teams to "consider assistive technology as a special factor when developing a student's IEP" (p. 113).

Individuals with Disabilities Education Act, Amendments of 1997

The Individuals with Disabilities Education Act, Amendments of 1997 (hereinafter IDEA 97) continued to expand access to the general education curriculum for

children with disabilities. Two of the main inclusions in IDEA 97 were the consideration factor and pushing for the LRE to be the general education setting.

IDEA 97 listed five special factors that the IEP team must consider in the development, review, and revision of each child's IEP. One of these five factors was "consider whether the child requires assistive technology devices and services" [20 U.S.C. §1414(d)(3)(B)(v)].

> Amendments to IDEA in 1997 extended assistive technology responsibilities to include several important mandates that further extended individuals' with disabilities rights including: (a) students should be educated in general education classrooms to the maximum extent possible, (b) IEP teams must consider AT for every student during the development of an IEP, and (c) AT may continue to enhance students' access to FAPE outside of the school (e.g., in the student's home). The legislation bolstered student access to the general education curriculum and placed increased responsibility on special education teachers and IEP team members to make informed AT decisions. (Marino et al., 2006, p. 19)

These Amendments to IDEA 97 defined every child's right to a Free and Appropriate Public Education (FAPE) and in doing so clearly relieved the student of the cost associated with assistive technology devices or services. The burden of the cost of assistive technology required by the student with disabilities was the responsibility of the public schools. IDEA "requires that assistive technology devices and services be provided to children and youth with disabilities if these are necessary to ensure a free, appropriate public education" (Lewis, 1998, p. 24), The 1997 Amendments to IDEA required public education agencies to insure that assistive technology is considered as a regular component in the IEP development process and if assistive technology devices or services are needed they are included as special education, related services, or supplementary aids or services within the student's IEP (Dalton, 2002).

Children with disabilities were starting to see better access to the general education curriculum. The requirement for every IEP team to consider the need for assistive technology is a giant step forward (Reed & Bowser, 1999). "It is an opportunity for parents to encourage a thoughtful discussion of the potential use of assistive technology for their child" (p. 58). IEP team members are required by IDEA 97 to consider assistive technology which is more than "simply making a check mark on the IEP that the team has considered AT" (Parette & Peterson-Karlan, 2007, p. 391).

Individuals with Disabilities Education Improvement Act 2004

The Individuals with Disabilities Education Improvement Act (IDEA 2004) was not proposed to overhaul IDEA 97, but rather to attend to some issues that had arisen during the intervening few years (Mittler, 2007). An important congressional finding was included in IDEA 2004:

> (5) Almost 30 years of research and experience has demonstrated that the education of children with disabilities can be made more effective by ....(H) supporting the development and use of technology, including assistive technology devices and assistive technology services, to maximize accessibility for children with disabilities. [(20 U.S.C. §1401 (c)(5)(H)]

"Assistive technology devices and technology services can be related services. When used to support a student in the regular class setting, they can also be considered supplementary aids and services" (Bartlett, Etscheidt, & Weisenstein, 2007, p. 92). It is important for teachers to consider every student individually to determine if they need assistive technology. Once the teacher and the team decide the assistive technology is necessary it needs to be placed in the IEP and provided to the student. The Code of Federal Regulations states:

> Sec. 300.105 Assistive technology. (a) Each public agency must ensure that assistive technology devices or assistive technology services, or both, as those terms are defined in Sec. Sec. 300.5 and 300.6, respectively, are made available to a child with a disability if required as a part of the child's--(1) Special education under Sec. 300.36; (2) related services under Sec. 300.34; or (3) Supplementary aids and services under Sec. Sec. 300.38 and 300.114(a)(2)(ii). (b) On a case-by-case basis, the use of school-purchased assistive technology devices in a child's home or in other settings is required if the child's IEP Team determines that the child needs access to those devices in order to receive FAPE
> (34 C.F.R. § 300.15) (Authority: 20 U.S.C. 1412(a)(1), 1412(a)(12)(B)(i))

One of the special factors to be considered under IDEA 97, "whether the child requires assistive technology devices and services" [20 U.S.C. §1414(d)(3)(B)(v)], was changed to read "consider whether the child needs assistive technology devices and services" [20 U.S.C. §1414(d)(3)(B)(v)] in IDEA 2004. Mittler (2007) speculated this change would possibly result in a more liberal interpretation of assistive technology which could lead to more students with disabilities being able to access available assistive technology devices and services.

Throughout history, the federal government has played a critical role in requiring considerations of assistive technology needs for students with disabilities. "This stimulation has been in the form of federal laws and regulations that have included technology mandates and funding to support a wide variety of technology research and development, training, and service activities" (Blackhurst, 2005a, p. 12), The Tech Act (1988) included the first definitions of assistive technology devices and services. It also authorized federal funds for states to initiate assistive technology plans. The ADA's (1990) intent was to eliminate discrimination and provide equal opportunities for individuals with disabilities. The ADA extended civil rights to people with disabilities in

both the public and private sectors and created access to public education for students with disabilities.

The Tech Act of 1994 was in response to Congress's dissatisfaction with the states' current assistive technology delivery systems. In response to the growing electronic and informational technologies, the 1998 Amendment to Section 508 required individuals with disabilities be provided access to any electronic or informational technology that was developed, procured, maintained, or used by the federal government. The AT Act (1998) extended funding provided in the 1988 Tech Act to assist states in "promoting awareness about assistive technology, provide technical assistance, outreach, and foster interagency coordination" (Blackhurst, 2005a, p.14). The Assistive Technology Act of 2004 required states to use a majority of federal funds to directly help individuals, switching the primary purpose from establishing systems to directly helping the individuals with disabilities that need assistive technology devices.

The IDEA 2004 continued to strengthen the educational outcomes expected for all individuals with disabilities. By providing special education services designed for each student's unique needs, the expectations were that all students with disabilities would be prepared for further education, employment, and independent living. Assistive technology could be one of these special education services that help students with disabilities meet these ongoing expectations.

The Individuals with Disabilities Education Act's main purpose was to guarantee the right of all children with disabilities to a free and appropriate public education in the least restrictive environment. Assistive technology devices and services may be viewed

as a method or valuable educational tool for students with disabilities to access a FAPE in the LRE. It could make things possible for students with disabilities that could not otherwise be obtained. The ongoing emphasis on assistive technology was a positive influence in the lives of children with disabilities.

Analysis

In summary, the literature clearly shows how The Tech Acts, ADA, and IDEA legislative initiatives have provided numerous programs and services to help people with disabilities have equal access and use of assistive technology devices and services. The legislative initiatives illustrate the importance the federal government has placed on assistive technology in the lives of children with disabilities. The combination of the appropriate assistive technology device and assistive technology services can enhance the likelihood of success and overall well-being for a student with disabilities.

This section of the literature review invited questions pertaining to the teacher's knowledge of legislation regarding assistive technology devices and services. Teachers need to know the laws and possess the skills to implement these laws and assistive technologies to effectively provide access to the general education curriculum and meet the challenge of providing the best education possible for all students with disabilities. Do teachers know these laws so they are able to provide the necessary opportunities for students with disabilities?

The continuous work of legislators to enact laws to benefit students with disabilities will be in vain if educators do not know and understand the legislative requirements. In order to meet the legal obligations of these statutes, teachers must have

a clear understanding of assistive technology devices and services and a methodology for identifying the assistive technology needs of students with disabilities.

What is Assistive Technology?

Assistive technology "can be broadly conceptualized as any technology with the potential to enhance the performance of persons with disabilities" (Lewis, 1998, p. 16) and "a means of empowerment" which if denied "exacerbates their disability's effects" (p. 25). Assistive technology does not alleviate or remove learning deficits, but it can help students achieve their potential by allowing them to take advantage of their strengths and evade areas of difficulty. Assistive technology compensates for a student's skill deficits or areas of disability. This section will describe assistive technology and the continuum of assistive technology.

Describing Assistive Technology

Distinguishing the difference between the terms assistive technology and instructional technology presents challenges. Assistive technology has been defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (IDEA,1990). The functional capability may be related to any activity the student needs to do such as" communicating, moving throughout the school environment, seeing, hearing, reading, writing, and so on. For any one of these capabilities, there may be anywhere from several dozen to several hundred items that enhance the student's functional ability" (Reed, 2003, p. 2) The vast

number of choices "illustrates why this field can be so confusing and overwhelming for many educators" (p.2)

In the past decade, technology has become smaller, cheaper, more powerful, and easier to use, which has created a fine line between instructional and assistive technology; they are often interrelated. One way of looking at the difference is that assistive technology is more personal to the student, whereas instructional technology is more classroom-based. However, the distinction is becoming blurred as computers are being used more often in all areas of education for all students. Edyburn (2011) delineated the difference between assistive technology and instructional technology by the audience to which it is provided. When assistive technology is provided to all students, it ceases to be assistive and becomes instructional.

Raskind (2008) proposed "AT for kids with LD is defined as any device, piece of equipment or system that helps bypass, work around or compensate for an individual's specific learning deficits" (p. 1). Assistive technology helps individuals with many types of disabilities from "cognitive problems to physical impairment" (p. 1). The use of assistive technology to enhance learning is an effective approach for many children: "students with LD often experience greater success when they are allowed to use their abilities (strengths) to work around their disabilities (challenges). AT tools combine the best of both of these practices" (p.1).

Assistive technology is not a cure for learning difficulties but it does allow the student to "reach her potential by capitalizing on her strengths and bypass areas of difficulty" (Raskind, 2008, p. 1). Assistive technology is merely the support to get the

job done more independently. It can reduce a student's reliance on parents, siblings, friends and teachers, thus helping the transition into adulthood, fostering self-esteem, and reducing anxiety. It is important to view assistive technology as a scaffold supporting students with disabilities to "extend their access to information, their abilities to convert that information to knowledge, and their communication of this knowledge to others" (Caverly & Fitzgibbons, 2007, p. 38).

Assistive technologies affect everyday life and learning for everyone by providing closed caption television, doors automatically opened by sensors, speed dial buttons on a telephone, internet searches, and electronic data organizers to "augment and extend" (Edyburn, 2000b, p. 22) human abilities. Over a lifetime, every person will personally encounter limitations that will impair basic life functions. As a result, assistive technology "has the potential to affect everyone, either directly, as a personal user of assistive technology, or indirectly, as a means of helping someone we know" (p. 22).

Assistive technology also includes the services and supports needed to determine those devices to meet the needs of the individual: "Assistive technology for students with learning disabilities are devices meant to scaffold students' cognitive processes in order to enhance each individual students' unique processing abilities and maximize learning outcomes" (Marino, Sameshima, & Beecher, 2009, p. 188) .

Assistive technology devices may serve as a vehicle "to help individuals with disabilities do what they want to do when they want to do it, thereby reducing the need to depend on others to do things for them" (Bryant & Bryant, 2003, p. 2), providing a means to an end, which is independence. Assistive technology " is really a concept, a

perspective as it were, that leads one down the road to making practical decisions about specific devices, services, and adaptations that can be used by people with disabilities, their advocates, and their family members to make independence possible" (p. 3).

In an attempt to make assistive technology more relevant to children with disabilities, Mistrett, Lane, and Ruffino (2005) declared assistive technology "must be child and family responsive, should require minimal training for its use, be readily available and enhance the child's participation in the routines within his or her natural environments" (p. 277). They further clarified assistive technology devices as a product that can make it possible for a child to move, eat, play, sit, communicate, and interact which makes the definition more applicable to young children. Assistive technology devices for growing young children may be used to develop the foundation for functional activities and broaden a child's existing abilities. Assistive technology should be used preventively to support the development of young children by bypassing or eluding immediate barriers to participation.

The definition of assistive technology may be conceptualized into three components: what it is, how it is made, and its use (Bryant & Bryant, 2003). The what refers to the unit itself which can be an item, a piece of equipment, or a product system. The how refers to

> Whether the device is purchased as an 'as-is' item in a store (e.g. motorized wheelchair from a mobility vendor), modified (e.g., the same chair, but with 'special features,' such as balloon tires for beach access), or customized (e.g., the same type of chair but one that is created specially for a person with very specific needs). (p. 3).

The significant element to this section of the definition is that the device can be acquired from an available "vendor, adapted from another device to tailor it to specific customer features, or made from scratch" (p. 3).

The third component, use, is the function of the device as it pertains to the user. The assistive technology device has to be able to be used "either to enhance a person's functioning or to maintain the functional level at its current level, that is to prevent a conditioning from worsening" (Bryant & Bryant, 2003, p. 3). Bryant and Bryant (2003) gave this practical definition of an assistive technology device: "An AT device is anything that is bought or made that helps a person with a disability accomplish a tasks that would be otherwise difficult or impossible to perform" (p. 4).

Three Conceptual Models

Bryant and Bryant, 2003. Bryant and Bryant (2003) illustrated assistive technology services by examining each of the phrases or elements of the legal definition, starting with the first element, a functional evaluation of the person in the individual's customary environment. It is important to recognize that assistive technology devices do not fit into the cliché of one size fits all. An evaluation must be conducted to be reasonably sure the device matches the "user's needs, attributes, and tasks to be done" (p. 6). This evaluation must also take into consideration the environment or environments that a person will be utilizing the assistive technology device.

The purchasing and/or leasing phrase is one that Bryant and Bryant (2003) deem as critical. Resources are not unlimited in a realistic world, so financial restraints may be

a barrier to accessing the benefits of assistive technology, as discussed later in the barriers section of this paper.

The selecting, designing, and fitting element coincides with the assistive technology evaluation as each term describes a portion of the evaluation process. This element of the definition requires a broad range of skills and knowledge from all persons involved in this process to provide the maximum benefits possible for each student with a disability. The selection, design, and fitting is dependent on the next element of the definition of assistive technology services, coordination and using other therapies or interventions. Bryant and Bryant (2003) caution that assistive technology devices do not exist in a vacuum is a predominant issue of this element. They gave this example: "When a child is matched with an aug com device, for example, the device becomes a tool to be used by the child and his or her speech-language pathologist as part of a speech-language therapy program" (p. 7).

The last two elements both deal with training as it pertains to the individual who is using the assistive technology device or anyone else associated including family or school personnel. All people involved in the use or the support of the use of an assistive technology device are entitled to training to ensure the full implementation of the device. Bryant and Bryant (2003) stated, "Some AT devices are simple to use and some are complicated, but all devices require training of the user in order to maximize use" (p. 7). The authors acknowledged that training or technical assistance for a professional or educator is particularly challenging. The vast amount of assistive technology devices and the services that support the use of that device can impact the level of knowledge an

educator may have on each particular device, therefore specific training must be provided for professionals.

Bryant and Bryant (2003) proposed assistive technology devices be organized into seven categories: positioning, mobility, augmentative and alternative communication, computer access, adaptive toys and games, adaptive environments, and instructional aids, based on how they are used by a student with disabilities. A positioning device aides a person to be in the best posture possible, whether they are sitting, standing, or kneeling. An assistive technology device in the mobility category would enable people to move about in various environments. Augmentative and alternative communication devices are to aide people in communicating with each other. A computer access assistive technology device would allow students with disabilities to access the computer using a variety of different modes. Adaptive toys and games "is an area of assistive technology that provides children with disabilities the opportunity to play with toys, games, and one another, thus allowing children to develop cognitive skills associated with these activities" (p. 5). Assistive technology devices in the adaptive environments category enable a student with disabilities to "manipulate the environment to allow for daily living, working, schooling, playing, and so forth" (p. 5).

Instructional aides are the devices which are utilized in schools to help a student have access to a free and appropriate education. Generally instructional aides are categorized under instructional technology. Bryant and Bryant (2003) illustrated the difference in instructional aides functioning as assistive technology or instructional technology by discussing how the device was used for two different students. One

student had a disability and used the assistive technology device to bypass an area of weakness while the other student used the device to improve skills. When the device is used to bypass an area of weakness, it fits under the broad scope of assistive technology, whereas if the device is used to improve a student's skills it is instructional technology.

These seven categories do not have specific boundaries and the types of assistive technology devices often overlap into different categories. The devices in these categories may all function individually but are quite often combined to provide the maximum benefit for a student with disabilities.

Assistive technology devices "are simply 'things' that are available for use. Without AT services, these devices would exist on catalog pages only, with no apparent use or even the ability to acquire the devices" (Bryant & Bryant, 2003, p. 6). The services are necessary "to decide what device to select, how to get the device, and how to use it; or how a person can use the device so that his or her goals can be met through the device's use" (p. 6).

Poel, 2007. Poel (2007) discussed the shift in accepted models pertaining to assistive technology. The medical model was the preferred perspective in the field prior to this shift. The medical model emphasized what an individual could not do. The University of Kentucky Assistive Technology Project introduced a new model called The Human Function Model, to guide the planning and delivery of assistive technology. The purpose of this model was to look at the individual and figure out how assistive technology will improve the ability to function within the environment. This model emphasized what an individual could do rather than focusing on the disability. The

Human Function Model "places assistive technology in its proper perspective, as an external support that can enhance an individual's ability to function within the environment" (Poel, 2007, |p. 64). The Human Function Model defined function as it relates to the action taken to respond to a demand or need.

The National Assistive Technology Research Institute (NATRI), housed at the University of Kentucky, organized the different kinds of assistive technology and services into seven categories that define an individual's needs. The seven categories are existence; communication; body support, protection and positioning; travel and mobility; environmental interaction, education and transition; and sports fitness and recreation. Poel (2007) summarized the NATRI Human Function Model and gave examples of assistive technology pertaining to each of these seven categories. Assistive technology devices that enable a person to perform functions that are necessary to sustain life are associated with the existence category. Examples include items to help with feeding, eliminating, bathing, dressing, grooming and sleeping. Devices include button hookers; weighted forks, knives, and spoons; plates and bowls with lips; straws; and long handled combs.

The functions in the communication category include oral and written expression, visual and auditory reception, internal processing of information, and social interaction (Poel, 2007). These devices can enhance inclusion of students with disabilities in the classroom culture. Single message switches allow students to respond to peers or teachers. Other communication aids may include "speech synthesizers, telephone

amplifiers, hearing aids, tape recorders, picture systems, and sophisticated augmentative communication devices, such as the Chat PC, Go Talk, or Tech/Speak" (p. 65).

Devices which aid individuals to maintain a stable position are included in the body support, protection, and positioning category. Examples in this category are braces, pillows, belts, and weighted vests which are used for extra supports. Book supports, special trays, or specially designed tables which all adapt for students using wheelchairs fit into this category. A variety of seating alternatives including the Move 'n' Sit or balance wedge are included in the support, protection, and positioning category (Poel, 2007).

Travel and mobility is the fourth category labeled by Poel (2007). "Activities in this category revolve around navigating the environment and include crawling, walking, using the stairs, and transferring from wheelchair to chair" (p. 65). Devices that enable individuals with disabilities to travel or be mobile include walkers, mobility canes, adapted tricycles, lifts, and prone standers.

Functions associated with the environmental interaction category are activities of daily living, such as turning a light on or off, using an alarm clock, switches for computers, touch screens, and Braille labelers. A specially designed mouse to navigate a computer, or a grabber to pick things off the floor or a high shelf are assistive technology devices that are familiar sights in the environmental interaction category (Poel, 2007).

Education and Transition functions "involve those associated with school events, therapies, and rehabilitation services" (Poel, 2007, p. 66). Assessments, creative and performing arts, and transitions to new environments are examples. Teachers should be

familiar with many of the assistive tools in this category including audio books, talking calculators, pencil grips, slant boards, colored overlays, and software programs that read, speak, enlarge, and organize text.

The last category reported by Poel (2007) is Sports, Fitness, and Recreation. These functions can be "associated with group and individual play, sports, games, hobbies, and productive use of leisure time" (p. 66). Facilitating participation of students with disabilities can be accomplished with a wide range of equipment including wheelchairs adapted for individual sports, Braille playing cards, balls with bells, switch activated spinners, and card and paper holders.

Poel (2007) concluded "Assistive technology can mean the difference between a student actively participating in the classroom or being an outside observer" (p. 66). Indeed, the essence of assistive technology involves using tools to augment and extend abilities of students with disabilities.

Blackhurst, 2005. Blackhurst (2005b) identified six distinct types of technology that impact education including the technology of teaching; instructional technology; assistive technology; medical technology; technology productivity; and information technologies. Blackhurst explained:

> Assistive technology employs various types of services and devices designed to help people with disabilities function within their environment. Assistive technologies include mechanical, electronic, and microprocessor-based equipment, non-mechanical and non-electronic aids, specialized instructional materials, services, and strategies that people with disabilities can use either to (a) assist them in learning, (b) make the environment more accessible, (c) enable them to compete in the workplace, (d) enhance their independence, or (e) otherwise improve their quality of life. These may include commercially available or "home-made" devices that are specially designed to meet the idiosyncratic needs of a particular individual (p. 176).

Each of the six types of technology can stand alone or may be used in combination with others. Blackhurst's (2005b) six categories and strategies are similar to NATRI's Human Function Model as recounted by Poel (2007).

Bryant and Bryant (2003), Poel (2007), and Blackhurst (2005b) all presented various yet similar conceptualizations of assistive technology. All three adopt the premise of the Human Factors Model that assistive technology is an external support that can enhance an individual's ability to function within the environment. Function was defined as it relates to the action taken to respond to a demand or need. Assistive technology can be described as assisting an individual in learning, making one's environment more accessible, enabling an individual to compete in the workplace, enhancing an individual's independence, or improving the individual's quality of life. Bryant and Bryant (2003) and Poel's (2007) models started with more narrow categories pertaining directly to assistive technology, whereas Blackhurst (2005b) had broader categories. Bryant and Bryant (2003) and Poel (2007) initiated their categories based on how an individual will utilize technology to improve their ability to function within their environment. Blackhurst's categories were more global. Assistive technology was one of the initial six categories and then it was tapered down to the student level. All three models have categories based on how assistive technology was used by a student and how assistive technology could enhance the individual's ability to function with life's demands.

IDEA 97 required that assistive technology be considered for all children with disabilities (Dalton, 2002; Lewis, 1998; Marino et al., 2006; Parette & Peterson-Karlan,

2007; Reed & Bowser, 1999). Teachers need to have insight to what assistive technology is to consider assistive technology. Teachers need to understand these conceptualizations to best determine how assistive technology can be utilized to offer the maximum benefits to children with disabilities. Teachers need to understand the broad array of assistive technology options and a method for determining which option best addresses student needs. To continue the description of assistive technology; the next section are examples of different interpretations of the assistive technology continuum.

Assistive Technology Continuum

IDEA 97 required the consideration of assistive technology devices and services for every student with disabilities during the development of their IEP. IDEA 97 also defined assistive technology devices and services. "However, these definitions are so broad that there is continuing confusion as to what is and is not included under the definitions of assistive technology devices and services" (Zabala et al., 2000, p. 26). A common misperception is that assistive technology is only computers and expensive or sophisticated devices (Bausch, Ault, & Hasselbring, 2006). There are many assistive technology solutions that do not involve any technology or computers at all. The organization of assistive technology devices on a continuum is controversial but it is one method of presenting a vast array of assistive technology supports. In conjunction with the continuum, the intensity of the application could be categorized. ABLEDATA (www.abledata.com) is a government website sponsored by the National Institute on Disability and Rehabilitation Research, part of the Office of Special Education and Rehabilitative Services of the US Department of Education. ABLEDATA's mission is to

"provide objective information on assistive products." They currently have over 40000 products listed on their website and it is increases daily. ABLEDATA uses 20 categories to organize this information. Their categories pertain to the function the device can provide for the user.

As advances in technology have grown, the interrelationship between assistive and educational technology has strengthened. Educational technology is any software or hardware designed to teach the general population of children ideas and concepts. The exploration of assistive technology parallels education technology. What was once considered educational technology might now be assistive technology for students with disabilities.

The National Assistive Technology Research Institute (NATRI) cautions all parties involved with the selection of an assistive technology device to always start at the low-tech end of the continuum. When attempting to match a device to a student's needs, starting with the low tech devices and progressing towards the higher level will provide the student the best opportunity to use the most appropriate assistive technology and the provider with the most efficient device. To establish a common mode of categorizing the wide range of assistive technology from the research or empirical literature is difficult and challenging. For the purpose of this research and as a benefit to the reader, assistive technology solutions are presented on a continuum: low tech, mid tech, and high tech.

Low-Tech. The National Assistive Technology Research Institute defined low-tech as non-electric devices, medium-tech as non-complicated mechanical devices, and high-tech as devices that incorporate sophisticated electronics or computers. Dell et al.

(2008) defined low-tech devices as being relatively inexpensive which make life's daily activities easier or even possible. Low-tech communication systems are non-electronic or those that use electronic components that are not computer based (Beck, 2002). Picture communication boards, alphabet boards, and eye gaze boards are examples of low-tech non-electronic systems. Jim Stachowiak, Associate Director of the Iowa Center for Assistive Technology Education and Research (ICATER), describes low tech as a device that typically does not contain electronic components, does not require a power source, has limited movable parts, is typically inexpensive, and can usually be purchased at a standard store (personal communication, August 11, 2011). Examples of low-tech devices include less sophisticated items such as adapted spoon handles, Velcro fasteners, and raised desks that can accommodate a wheelchair (Blackhurst, 2005a; Floyd, Canter, Jeffs, & Judge, 2008) and pencil grips and mouth sticks (Behrmann, 1998).

Mid-Tech. Mid-tech devices are electronic in nature but are much less expensive and require less training than high-tech devices which are often based on computer technology. The National Assistive Technology Research Institute described medium-tech as non-complicated mechanical devices. Other examples of mid-tech devices include manual not electronic operated items (Behrmann, 1998), solutions including the use of less complicated electronic or mechanical devices such as video cassette players and wheelchairs (Blackhurst, 2005a), and items that have some movable parts, require some training, use batteries or USB power if a power source is required, need basic assistive technology to obtain, and are generally more expensive than low-tech but

typically not as expensive as high-tech (J.R. Stachowiak, personal communication, August 11, 2011).

High-Tech. The National Assistive Technology Research Institute defined high-tech as devices that incorporate sophisticated electronics or computers. High-tech devices are powerful, flexible, and offer unique benefits which can be used for many different tasks (Dell et al., 2008). High-tech systems refer to microcomputer components, including hardware and software, and allow for storage and retrieval of message information (Beck, 2002). Other descriptions of high-tech devices include: the use of sophisticated devices, such as computers and interactive multimedia systems (Blackhurst, 2005a); powered mobility equipment (Judge, 2000); solutions typically involving the computer or having computer components, such as specialized software and advanced hardware devices (Floyd et al., 2008); and solutions that require a power source, or being run on a device that has a power source; require substantial training, typically considered expensive; have sophisticated electronic/code components; and typically are only obtained by someone with significant assistive technology knowledge (J.R. Stachowiak, personal communication, August 11, 2011).

High-tech devices usually involve a combination of devices that are dependent on each other. Specially designed software that must be combined with a computer or specific tool that can read the program usually falls towards the high end of the continuum. Devices within the high-tech category may require complex technological support, including the support of an instructional technologist. One assumption could be that the closer the device is to the high end of the continuum the more sophisticated the

device is and therefore it becomes more expensive as it takes more resources to develop (Parette & Peterson-Karlan, 2007). The high-tech device is more limited as it is designed to alleviate specific challenges, such as a device that is programmed to read an individual student's eye gaze. With the new and ongoing technological discoveries happening in this world, the opportunities for students with disabilities are always expanding.

Types of assistive technology have been loosely classified into categories on the assistive technology continuum. Table 1 includes examples of assistive technology under each category on the assistive technology continuum. This is not an exhaustive list but reflects examples stated in the literature reviewed for this study.

Table 1

Assistive Technology Continuum

Category	Examples
High Tech	-Multiple level voice output devices -Text to speech devices -Speech recognition software -Communication devices -Telecommunication devices -Eye gaze technology devices -Alternative keyboards
Medium Tech	- Talking calculators -Books on tape or digital formats - Communication boards - Timers - Simple Switches - Picture symbols - Talking picture album
Low Tech	-Raised line paper -Specialty pens or pencils -Colored overlays

The categories and examples of the assistive technology continuum are not discrete and dichotomous, but are arbitrary. Clear distinctions between the categories cannot be determined as specific devices may fit under different categories, depending on the purpose for a student with a disability. As with the definition of assistive technology, the variety of terms used to describe categories in the assistive technology continuum vary but they do not change the original definition or the intent of the assistive technology continuum. The Georgia Project for Assistive Technology (GPAT; 2003) perceived the ambiguity in the definition of assistive technology could give IEP teams an advantage by offering flexibility. The large encompassing umbrella of assistive technology devices allows teams to make individualized decisions regarding which technology device is most appropriate for each student with disabilities.

However organized or categorized, teachers need to know and understand the broad concept of a continuum of assistive technology devices. Teachers must consider if a child needs assistive technology to overcome barriers to a FAPE. If it is determined by the IEP team that student with disabilities requires assistive technology to access a FAPE, then an evaluation must take place to match the needs of a student to an assistive technology solution.

Evaluation

Several documents containing guidelines have been produced to assist with the evaluation process pertaining to assistive technology. Iowa does not have a specific framework that must be utilized during the evaluation. The frameworks reviewed for this study all contain similar steps for evaluating a student's needs for assistive technology.

The Quality Indicators for Assistive Technology Services (QIAT) Assistive Technology Assessment Process Planner will be described in this study.

Assistive technology assessment is not a clearly defined or uniform process, but there are several models to guide assessment available. Dell, et al. (2008) describe

> seven elements that are the hallmarks of an exemplary assistive technology assessment: (1) Use of a team approach; (2) Focus on student needs and abilities; (3) Examination of tasks to be completed; (4) Consideration of relevant environment issues; (5) Trial use of assistive technology; (6) Providing of necessary supports; and (7) Viewing of assessment as an ongoing process. (p. 192)

Many states have developed guidelines including checklists for technology assessments. The Wisconsin Assistive Technology Initiative (WATI), the Georgia Project for Assistive Technology (GPAT), and the Oregon Technology Access Program (OTAP) are examples of these assessments. The WATI, GPAT, and OTAP are all developed from the concepts of the decision-making guides. The decision- making guides, Quality Indicators for Assessment of Assistive Technology Needs and the SETT Framework, were not developed by individual states but by teams of experienced assistive technology specialists. These guides contain principles for states to base their work from. A brief discussion of these decision-making guides follows.

Quality Indicators for Assessment of Assistive Technology Needs

Quality Indicators for Assistive Technology Services (QIAT) is a "set of descriptors of critical elements related to major functions involved in the provisions of assistive technology services" (Zabala et al., 2000, p. 179). The primary purpose of QIAT is to "support thoughtful development, provision, and evaluation of assistive technology services for student with disabilities, regardless of where the services are

provided or the specific model used to support service provision" (p. 179). The QIAT Consortium, a group of assistive technology service providers from diverse geographical areas with a broad range of experience, developed the following set of seven indicators for assessment of assistive technology needs (Zabala et al., 2000):

> 1. Procedures for all aspects of assistive technology assessment are clearly defined and consistently applied.
> 2. Assistive technology assessments are conducted by a team with the collective knowledge and skills needed to determine possible assistive technology solutions that address the needs and abilities of the student, demands of the customary environments, educational goals, and related activities.
> 3. All assistive technology assessments include a functional assessment in the student's customary environments, such as the classroom, lunchroom, playground, home, community setting, or work place.
> 4. Assistive technology assessments, including needed trials, are completed within reasonable timelines.
> 5. Recommendations from assistive technology assessments are based on data about the student, environments and tasks.
> 6. The assessment provides the IEP team with clearly documented recommendations that guide decisions about the selection, acquisition, and use of assistive technology devices and services.
> 7. Assistive technology needs are reassessed any time changes in the student, the environments and/or the tasks result in the student's needs not being met with current devices and/or services. (QIAT, 2005)

From these indicators one could conclude that it is important to define the procedure used to assess, have a multidisciplinary team, conduct the assessment in the student's typical environment, gather data while conducting trials to implement an appropriate assistive technology device, and continue to monitor the effectiveness of the device. These indicators are intended to be guidelines for anyone conducting an assessment regarding assistive technology. The indicators included do not "recommend or endorse a specific assessment procedure. Instead, they advocate that educational

agencies clearly articulate an assessment process and use it consistently" (Dell et al., 2008, p. 201).

SETT Framework

The author of the SETT framework, Joy Zabala was a member of the original QIAT Consortium. The intent of the SETT framework was to provide a set of guidelines to aid in gathering data and a place for educators to start to make decisions regarding assistive technology needs of a student (Zabala, 1995). The student, their environment and the tasks required must be reviewed before tools are selected (Zabala, 1995). Thinking about the student, questions should be asked about the student's strengths and what does the student need to do that they are not able to do now? Applying the SETT framework to a fictitious student might clarify the steps. Jon (student) is five years old and struggles with decreased muscle strength and decreased fine motor skills which causes fatigue. The environment has a big impact on choosing the appropriate assistive technology device. Questions about the environment might include; what is currently available, physical arrangement, supports or resources available, and will the environment change? (Zabala, 1995). Jon is in the regular kindergarten classroom in a wheelchair with a tray (environment). There is a height adjustable table in the classroom. Looking at the task identifies what takes place in the environment, what activities support the curriculum and how might these activities be modified to accommodate the student's needs? Jon's task is to complete written work. This work can be completed with pencil and paper or with the computer. There is one desktop computer in the kindergarten classroom.

Once the student, the environment, and the task have been considered then the decisions regarding the tools can be initiated (Zabala, 1995). These questions will be addressed towards what types of assistive technology tools will best meet the student's needs and how will these tools be tried out? Including all four components in the quest to provide assistive technology for a student with disabilities will lead to the best solution for the student. Jon's school has one interactive whiteboard, the desktop computer in kindergarten, and a height adjustable table. Jon has a laptop computer at his home.

Once this background information has been gathered, the team can proceed to ask more questions and start trials of specific assistive technology devices. For Jon to complete a literacy skills worksheet, the team suggestions might include handwriting aids such as a larger pencil, a pencil grip, or a weighted pencil, on the low-tech end of the continuum and work up to a device that will import Jon's voice into a computer where the worksheet has been scanned. At each step of the trials of assistive technology devices, the team must ask questions. Does the device resist fatigue, does it assist with the fine motor activity, is it available at the school or how could it be obtained, will Jon or the teacher or family need training on the device? These are examples of the ongoing process involved in an evaluation of a student for assistive technology.

Some states have taken these guidelines and created specific assessment procedures to evaluate students with disabilities in their states (Zabala et al., 2000). Iowa is not one of these states. Iowa does not have a certain set of procedures that must be used during the evaluation. Each Area Education Agency in Iowa has a person assigned to coordinate assistive technology devices and services in their area. This person and

anyone else in Iowa evaluating a student's need for assistive technology is free to use any assessment piece they have available to them.

Consideration for assistive technology may occur at multiple steps of the IEP development process. During the development, IEP team members must examine present levels of performance which includes reviewing past and current assistive technology use and its efficacy. The central assistive technology question being explored is, "Is AT needed?" (Parette & Peterson-Karlan, 2007, p. 392). This question is recursive, considered repeatedly while developing goals, considering placement alternatives, and identifying appropriate supports and services including existing assistive technology.

There are numerous assistive technology devices that may be helpful to students with disabilities, but not all devices are appropriate for everyone (Bryant et al., 1998). Because students with disabilities possess "individual strengths, weaknesses, interests, and experiences, a device that may be appropriate for one person may not be appropriate for another" (p. 53). This is also true for assistive technology devices in particular settings. "Therefore, it is important to evaluate an individual for AT devices relative to the specific student's strengths and limitations, setting(s), and task(s) to be performed" (p. 53).

The evaluation process is important. A teacher plays a valuable part in this evaluation. The teacher needs to know the steps to insure a quality evaluation, the questions to ask, and places to seek information from.

Teachers take the main role in making assistive technology decisions but they also need the support of the IEP team members. The evaluation process is dependent on the

knowledge of the teacher and other IEP team members. The teacher needs to know what assistive technology is which is a large task and one that is constantly changing. The teacher needs to know and understand how assistive technology is classified to make the best decisions possible for a student with disabilities. The teacher needs to have a methodology to screen children's assistive technology needs.

The teacher's knowledge pertaining to assistive technology plays an important role in meeting students' needs through the use of assistive technology (Beigel, 2000; Michaels & McDermott, 2003; Nelson, 2006). "A critical factor in students' use of technology is their teachers' technological knowledge and skills" (Abner & Lahm, 2002, p. 101).

Analysis

In summary, the literature review explored the many categories, classifications, and definitions of assistive technology. The variety of definitions, categories, or classification systems does not change the concept that assistive technology has notable potential to enhance the educational performance of students with disabilities. Bryant and Bryant (1998), Blackhurst (2005b), and Poel (2007) all provided conceptualizations of assistive technology. However, it does bring up questions to explore. "Is AT needed?" (Parette & Peterson-Karlan, 2007, p. 392). If an IEP team determines assistive technology is necessary for a student with a disability, how does the team know what assistive technology is and what is available to meet the unique needs of a student?

In order for students with disabilities to reap the many benefits through assistive technology devices and services, a teacher needs to have knowledge regarding the

evaluation process of assistive technology. The following section of the literature review will focus on the benefits of assistive technology and measuring the effectiveness of assistive technology.

Benefits of Assistive Technology

Although people are familiar with the larger mobility and visible assistive technology devices such as wheelchairs, walkers, and computers, many educators and parents remain unaware of the potential benefits of using different types of assistive technology in educational settings. Assistive technology has remarkable potential to improve educational performance of students with disabilities. When assistive technology devices and services provide access to the general education curriculum, this engagement in turn provides more opportunities for social inclusion and enhancement to the student's self-esteem or self-management abilities.

Nearly all researchers and other authorities who are knowledgeable on assistive technology (Behrmann, 1994; Blackhurst, 2005a; Derer et al., 1996; Edyburn, 2005; Todis, 1996) concur the quality of education and the quality of life potentially improves with the utilization of technology for students with disabilities. By using assistive technology, students with disabilities can be integrated in activities that might not otherwise be available or accessible to them. One of the greatest benefits of assistive technology may be its capacity to enable students with disabilities to access a task that could not have been done before, or reach a specific ambition that otherwise would not have been possible (Copley & Ziviani, 2004). Assistive technology has the power to allow students with disabilities to actively engage in learning with their classmates. This

section of the literature review is focused on the benefits of assistive technology. It is organized into the categories access to learning benefits, social interaction benefits and self-management benefits.

Access to Learning Benefits

Numerous writers have demonstrated the effectiveness of using assistive technology devices with students with disabilities to foster academic success and independence and to compensate for reading, mathematics, writing, spelling, and other difficulties (Bryant et al., 1998; Bryant & Seay, 1998; MacGregor & Pachuski, 1996). Specifically, studies have examined the access to learning benefits provided through assistive technology including rate of engagement, level of productivity, and skill acquisition.

Derer et al. (1996), describe the Analysis of Technology Assistance for Children (ATAC) Project, which was initiated because of the limited information available on current practices in field applications of assistive technology. "Specifically, the ATAC project focused on investigating three problem areas: (1) the status of assistive technology in educational and related settings with school-age children with disabilities; (2) the benefits and barriers associated with using assistive technology for these youngsters; and (3) the effects of assistive technology use" (Derer et al., 1996, p.62). This project was conducted in special education classrooms across Indiana, Kentucky, and Tennessee. A total of 1266 surveys were dispersed to schools in these three states, with thirty-two percent of the surveys being returned. "Returned surveys typically came from teachers working in integrated public school settings, serving the full age range of

public school students in resource rooms and self-contained settings" (p.64). The authors analyzed the data and classified it under four major areas: environmental, interdependence, student, and esoteric issues.

Environmental issues were related to changes in students' social and instructional ecology. Respondents' comments under this section pertained to assistive technology facilitating inclusion in the student's natural setting. Assistive technology helped the student overcome environmental or social barriers which allowed greater participation and interaction with peers. Derer et al. (1996) also categorized learning benefits under environmental issues. Comments made suggested assistive technology improved the instruction, feedback, or individualized instruction to students with disabilities which in turn was a positive impact or benefit on a child's academics.

Interdependence issues included "comments that assistive technology allowed the user to circumvent or minimize the impact of the disability (Bypass); that it enhanced the user's capacity to express feelings, thoughts, or ideas (Communication)" (Derer et al., 1996, p. 69). The most frequently identified benefit within the interdependence issues was "the capacity of assistive technology to promote communication and expression" (p.69). If communication was enhanced then a student's ability to learn and express his or her ideas was also increased. Boosting communication and expression would have a positive impact on the total academic benefit of a student with disabilities.

The third area of comments categorized by Derer et al. (1996) was a student issue. Productivity as it pertained to completion of assignments or tasks also was mentioned as a benefit. "Respondents frequently mentioned skill improvement (e.g., proficiency,

competency, or communication) as well as increasing the opportunity to practice or apply skills (use)" (p. 69). Approximately nine percent of the respondents stated they felt children's skills improved through using assistive technology. The overall message related by these comments was "It enhances the learning of the students" (p. 70). Few respondents mentioned improvement of a specific skill.

The fourth area of comments, esoteric issues, was the second most frequently reported benefit (Derer et al., 1996). Comments in this category were more abstract and idealistic than those in the other categories. Comments included becoming more normal or better able to function in the world. Quality of life, fulfillment, and equality were also mentioned.

Most researchers would agree that assistive technology does not cure or eliminate academic struggles, but assistive technology can help students reach their potential by capitalizing on their strengths and bypassing areas of difficulty. The teachers in Kentucky, Indiana, and Tennessee who participated in this study alleged that assistive technology might be a key to unlocking the door to learning for children with disabilities. The comments received in this study support the claim that assistive technology may be an access to learning for students with disabilities.

Carnahan, Basham, and Musti-Rao (2009) measured the benefits of a low-technology strategy with students on the autism spectrum with significant learning needs. The assistive technology was an interactive book paired with music. The study was conducted over an eight-week period in a self-contained elementary classroom in a large suburban area in the Midwest. "To participate in the specialized classroom setting, the

students demonstrated a need for intense structure, visual supports, and highly specialized instruction that were not provided in the general education setting" (Carnahan et al., 2009, p. 78). The six participants' range of age was 6 years 10 months to 11 years 5 months. Five of the participants were identified with autism; the sixth student had a "school-based identification of other health impairment (OHI) similar to the learning needs and behaviors of the students with autism" (p. 78). The dependent variable in this study was student engagement during small group instruction with engagement being specifically defined for all observers. The independent variables were interactive books, with and without supporting music. Baseline data was collected. The teacher implemented a read, request, and comply/non-comply process to engage students with the interactive books. Data was collected on individual levels of engagement using a six second interval recording system. If the student was engaged at all during the interval the observer marked a "yes"; if the student was not engaged during any part of the six second interval a" no" was marked. The results demonstrated the interactive books, the assistive technology device, increased the rate of engagement during small group instruction for students with autism. The authors stated "From a technology perspective, this study demonstrates that the use of low, non-complex technology can produce desired outcomes" (p, 84). The implications and the data collected in this study support the claim that assistive technology may function as a benefit to students with significant learning disabilities.

In an attempt to measure the effectiveness of assistive technology as it pertains to the content area of writing, Cullen, Richards, and Frank (2008) specifically addressed this

research question: "What are the effects on the performance of seven students with special needs when a talking word processor with spell checker software is used independent of and in conjunction with word prediction software as accommodations in daily writing exercises?" (p.35). The participants were seven fifth grade students with mild disabilities who were receiving services in the same resource and inclusive fifth grade classrooms. Each of the participants had written expression goals on their IEP. This study took place in a diverse, urban elementary school in Ohio. Cullen et al. (2008) used a case study approach with modified multiple baselines including three phases: "baseline, intervention using a talking word processor, and intervention using word prediction software in conjunction with a talking word processor" (p. 6). Qualitative data were collected through field notes and interviews of the participants and quantitative data were collected using the students' writing samples. The baseline phase was one week long with three handwritten writing samples collected from each participant. The second and third phases each lasted for three weeks, with a maximum of nine writing samples per participant in each phase being collected. In the second phase, "students used Write: Out Loud Version 3 (1993-1998) a talking word processor with spell checker function computer software program" (p. 36). In the third phase, the intervention was both the Write: OutLoud program and a talking word processor with a word prediction component called Co: Writer 4000 Version 4.1 (1992-2003).

After data were collected, the authors analyzed the data quantitatively for four dependent variables: mean number of words; mean number of misspellings; accuracy percentage; and total rubric score. The results were summarized for the whole group and

individually. "As a whole group, the participants improved on each dependent variable during both intervention phases" (Cullen et al., 2008, p.37). Cullen et al. (2008) concluded "The results of this study suggest that computer software that provides writing accommodations can benefit students with disabilities" (p. 42). This conclusion supports the claim that assistive technology may provide an access to learning for students with disabilities.

Travis and Geiger (2010) conducted a mixed research design study with students with autism spectrum disorder (ASD) in South Africa to determine the effect of the Picture Exchange Communication System (PECS) "on the frequency of requesting and commenting behavior and the length of verbal utterances of two children with ASD" (p. 41). Two 9-year-old males with receptive and expressive language difficulties were recruited for this study. Both of the boys attended a special school for children with Autism in South Africa, but neither of the boys had any prior experience with PECS training. The participants both spoke English but had limited intentional communication skills. The study was conducted over eight months with the data collection stages involving approximately four months. After a 3 month interval without direct training of the intervention, data were collected for two weeks to measure the maintenance of the skills obtained using PECS. Following all of the data collection a semi-structured interview with educators and parents of the participants was conducted. The data were analyzed quantitatively and qualitatively and showed positive results of implementing PECS as an assistive technology tool. The average number of communicative attempts for participant one increased from 3 to 43 and for participant two the attempts increased

from 2 during the baseline to 50 during structured intervention settings. These findings confirm the phases of PECS training had the desired effect on the communication behaviors of the two participants. PECS could be classified as an effective assistive technology tool to access learning benefits for both of these participants.

A study conducted by Howell, Erickson, Stanger, and Wheaton (2000) investigated the effects a software-based early intervention reading program would have on the early reading abilities of students with disabilities in first grade. The participants in this study were first grade students with disabilities from inclusive classrooms across six states. IntelliTools Reading software was the assistive technology implemented with these students. The results were favorable for students. " The students in this study, coming from different geographic regions throughout the United States, from a variety of school settings, and with a variety of disabilities all achieved measurable gains in their phonemic awareness, word reading, and word writing skills" (p. 13).

A study which investigated the impact of cognitive organizers, with the integration of technology, Inspiration 6, compared to the traditional textbook instruction format on content-area learning in high school inclusive social studies classes was conducted by Boon, Burke, and Fore (2006). Forty nine students participated: 29 tenth-grade general education students and 20 students identified with mild disabilities. Students were randomly assigned to two groups; one which would receive instruction using the assistive technology device, a cognitive organizer, and the second group a traditional textbook format of instruction. "Students in the cognitive organizer condition served as the experimental group, while the students in the traditional textbook

instruction condition served as the control group" (p. 6). The study took place over three weeks and a pretest/posttest treatment control group design was used to examine the effectiveness of cognitive organizers as assistive technology tools. Results of the pretest were statistically analyzed using a one-way between-subjects analysis of variance (ANOVA) for students in both groups. The results indicated no significant differences between the students' knowledge on the pretest for content (Boon et al., 2006). "However, after the intervention, the mean post-test score of students in the treatment condition was 52.4, the mean post-test score for students in the control condition was 26.84" (p. 8), a significant difference. These results corroborate earlier research implications. Cognitive organizers can have a significant impact on the acquisition of social studies knowledge for both students with and without disabilities.

Schlosser and Blischak (2004) conducted a study to "determine the effects of synthetic speech and print feedback on spelling acquisition and generalization by children with autism and little or no functional speech" (p. 849). This study was an attempt to replicate an earlier study by Schlosser but involved more participants. Four boys ages 8 to 12 who met the following criteria were the participants in this study: (a) used a SGD (speech generating device) or talking word processor as their primary communication method for less than three months; (b) no uncorrected visual or hearing impairment; (c) ability to type; (d) an unequivocal diagnosis of mild to moderate autism; (e) mild intellectual disabilities according to school records; (f) natural speech that is not functional to meet daily classroom needs; (g) chronological age between 8 and 12 years;

(h) poor spelling skills (i) use of phonetic cue reading; and (j) ability to follow simple directions according to teacher reports.

Two research assistants trained in speech-language pathology carried out the experiment. The SGD, the Light WRTITER- SL35, was the assistive technology device utilized in this study. The experimental design applied was an adapted alternating treatment design with the study being conducted across seven phases: social validation, pre-assessment, baseline probes, acquisition probes, instruction, maintenance probes, and generalization probes. Data were collected on each of the participants in each of the seven phases.

The results of this study were consistent with the results of Schlosser's earlier statement in that participants reached criterion across feedback conditions. "Thus, spelling instruction with SGDs was effective regardless of whether participants received auditory feedback from synthetic speech output, visual feedback from the print on the LCD, or a combination of both" (Schlosser & Blischalk, 2004, p. 859). These results also provide empirical evidence of the efficacy of the statement that assistive technology can provide access to the general education curriculum and be a benefit for students with disabilities.

Cihak and Bowlin (2009) investigated the benefits of the use of video modeling as an instructional delivery system in acquiring and maintaining basic geometry skills. Their study's participants were three high school students identified with learning disabilities. All three of the students received more than 15 hours of special education services per week and participated in a before school math tutor program. The assistive

technology device, a handheld computer, was utilized for homework as well as in class work. The student's accessed teacher-created video clips on a tablet computer. The software and the tablet computer were selected "because they allowed the teacher to write, illustrate, and solve geometric problems using a stylus to demonstrate the mathematical processes while simultaneously recording a voice" (p. 19). At the start of each session the participants were each given a ten question quiz, a calculator, a pencil, and paper. The students were asked to do their best on this quiz which established the baseline. Once a stable baseline had been established, the students were instructed to take the handheld computers home and independently complete a ten question assignment. The students could view the video and instructions on the computer as many times as necessary. The students turned in their homework as soon as they returned to school the next day. If the student had a perfect score, the teacher administered a ten problem quiz. The student did not have access to the handheld computer during this quiz. If a student missed any questions on the homework assignment they were not allowed to take the quiz at school and were instructed to take the handheld computer home and fix the errors on their homework. The students were required to score 100% on three consecutive quizzes before moving on to the next lesson. Six week follow up probes were collected in the same manner as the quizzes. The results were consistent for all three participants. The mean for each area was 6% during baseline, 93% during intervention, and 89% at the six week follow up probe. Results of this study support that assistive technology provides benefits to students with disabilities. The participants in

this study also reported they enjoyed the use of the video modeling and handheld computers to improve their geometry skills.

Beck (2002) conducted a study to examine how assistive technology affected emergent literacy skills of preschool children with disabilities. The participants in the study were ten 3 year old children who attended preschool 150 minutes per day for five days a week. All of the participants were entitled to special education services. A case-study method was employed and data were collected using observations, anecdotal data, and checklists. The assistive technology devices used in this study included Picture Communication Symbols, adapted books, a BIGmack switch, and a computer with Intellikeys, Intellipics, and Overlay Maker which are alternate keyboards and software. Beck (2002) described emergent literacy as literacy activities focusing on "oral language, early experience with print, picture books, and writing" (p. 44). The assistive technology devices were incorporated into daily activities in the preschool classroom.

Beck (2002) continuously incorporated new activities which utilized assistive technology devices during the school year. Data were collected and analyzed not only for this study but for instructional decision making. Beck summarized her findings in this statement, "Integrating assistive technology into emergent literacy activities appears to increase, maintain, or improve the skills necessary for reading" (p. 47). Beck observed students spending more time with books, reading the stories, commenting on the pictures, and retelling the stories. These implications all lead to increased academic benefits to students with disabilities by preparing them for the world of literacy.

A study conducted by Hetzroni and Shrieber (2004) would support that assistive technology can have benefits when utilized by students with disabilities. The results of this study provided "support for the effectiveness of a computer-based word processing system for enhancing classroom academic outcomes" (p. 152). The purpose of this study was to investigate the effects of using a word processor program installed on a computer as an assistive technology device. The participants in this study were three male students, 12 to 13 years of age, enrolled in junior high in Israel. The three boys all had similar keyboarding skills. A single-subject research design was used with the word processor as the independent variable being implemented in Phases B1 and B2. Pens, markers, pencils, and a ruler were provided for Phases A1 and A2 of the study. The dependent variables measured in this study were as follows: (a) percentage of spelling errors taken from all final products; (b) percentage of errors in the oral reading of final products; (c) total number of words including errors in the text of all final products; and (d) text structure and organization. Phase A1 was the baseline and Phase B1 was implementing the assistive technology device. Phase A2 was withdrawing the assistive technology device, and Phase B2 was bringing back the word processor as the assistive technology device. The results "provide support for the effectiveness of a computer-based-word-processing system for enhancing classroom academic outcomes" (p. 152). The study suggests that by using the assistive technology device, these three boys "were able to produce material that was more acceptable by class standards" (p. 152). The results concur with the results of previous studies which found that the use of an assistive technology device can improve the written outcome of students with disabilities.

Improvement in written outcome may provide an access to learning for a student with a disability to capitalize on their strengths. Students with disabilities can also capitalize on social benefits through the use of assistive technology devices and services.

Social Interaction Benefits

As part of IDEA, the least restrictive environment (LRE) is identified as one of the six principles that govern the education of students with disabilities. The LRE mandate requires that a student with a disability should be educated with a non-disabled peer to the greatest extent possible. The student should be provided with supplementary aids and services necessary to achieve educational goals in settings with non-disabled peers. The increase of social interaction or inclusion with peers may be a benefit for a student utilizing assistive technology. All students tend to learn better with their peers. With an increase in inclusion, students with disabilities will have more opportunities to interact and learn from their peers in the general education setting. Behrmann (1998) makes this powerful statement, "assistive technology can be a great equalizer by overcoming obstacles that may have forced placement in a special segregated classroom or required a fulltime instructional aide" (p.1). Achieving the goal of the LRE provision may be enhanced through the provision of assistive technology devices and services. Assistive technology can provide a bridge in the communication gap by providing the tool a student with disabilities needs to communicate with others in their surroundings.

Hutinger et al. (1996) conducted a study with 14 children with multiple disabilities. Group I included seven young children who ranged in age from two to eight years of age when the study began. Group II also contained seven children with ages

between seven and thirteen years at the beginning of the study. These children were enrolled in eleven school districts in western Illinois and had two to ten years of experience with assistive technology before the study took place. The study had four major purposes: (1) describe how assistive technology was being used in educational and related settings; (2) describe the effects of assistive technology use; (3) analyze the benefits, challenges, and barriers of assistive technology use; and (4) determine future implications (Hutinger et al., 1996).

Investigators used a modified longitudinal approach to evaluate assistive technology outcomes including direct observation, videotapes of the children, questionnaires, and interviews with the teachers and parents to collect data. They also incorporated data pertaining to previous use of assistive technology to create a comprehensive picture of technology use and its impact. Parents or caregivers identified assistive technology as a means of providing families and professionals with opportunities, equipment, and resources to encourage social and emotional development, autonomy, and independent behavior of children with disabilities. Students were reported to be more independent, interactive with peers, confident, outgoing, and happy to be in the presence of their peers.

In the Cihak and Bowlin (2009) study outlined in the previous section, the students were interviewed following the intervention. The students conveyed a positive message about the use of the video modeling via handheld computers. "Students stated they had a sense of improved confidence using the technology and thought it would benefit them" (p. 26). Students felt the handheld computer was an unobtrusive device in

a high school classroom. The attendance rate of each of the students led the authors to believe the students were highly motivated to participate in the study. The results of this study support the claim that assistive technology can benefit the social acceptance of a student with disabilities.

In addition to empirical studies other authors have discussed the benefits of assistive technology. Lahm and Nickels (1999) stated that using a high-tech assistive technology device like a computer could promote student interaction, and this collaboration may provide unique opportunities in the classroom. Computers seem to be motivating most students to participate in learning content in new and different ways. The use of assistive technology for students with disabilities also necessitates collaboration and communication with other professionals, administrators, parents, and other important people in the life of the student.

Lahm (2003) emphasized that the benefit for students will only be forthcoming if the special education teacher is able to examine the specific demands of a task or function of a student, measure the student's ability to meet those demands, and identify the appropriate assistive technology that could assist the student in meeting those demands. This match is crucial to maximize the benefits of assistive technology to a student and to circumvent purchasing technologies that will not meet the needs of the student and thus diminish monetary resources.

Assistive technology benefits students with disabilities by assisting them in learning, making the environment more accessible, enabling students to compete in the workplace, enhancing their independence, and otherwise improving their quality of life

(Blackhurst, 2005b). Blackhurst stressed the point that assistive technology is "a tool for the delivery of instruction" (p. 176). He followed this with the concept that assistive technology devices are "means to an end, not an end in themselves" (p.176), and "Thus, use of technology cannot compensate for instruction that is poorly designed or implemented" (p.176). Blackhurst acknowledged the benefits assistive technology could provide but also stressed the necessary concept of continuing to study the application of assistive technology devices and services to generate informed decisions to enhance these benefits for students with disabilities.

In Michaels and McDermott's (2003) national survey, the authors acknowledged that "the appropriate application of assistive technology may be one of the greatest equalizing forces in the education and meaningful inclusion of students with disabilities, both in terms of promoting access to the general curriculum and in facilitating the ability of students to demonstrate mastery of that knowledge" (p.29). Floyd et al. (2005) conducted a literature review of assistive technology and emergent literacy skills. These authors concluded that assistive technology can benefit children with enhanced chances for "socialization, communication attempts and interaction, increased self-esteem and confidence, as well as developing language and communication skills" (Floyd et al., 2005, p. 93). Assistive technology has the ability to provide tools for children to take part in their own learning, thus becoming active learners instead of passive learners.

In 1994, Behrmann identified an increase in access for inclusion and amelioration of learning difficulties as benefits due to the use of assistive technology. Behrmann (1994) stated the case that technology can be a great equalizer for individuals with

disabilities for a higher level of participation in school, work, and the community. In the past, this was most evident in the circumstances of individuals with mobility, hearing, or vision impairments, but this benefit has more recently become evident for individuals with limitations in cognition and perception. Assistive technology has the power to overcome a forced placement in a special segregated classroom or a required full-time instructional aide. Assistive technology can provide the opportunity to bring more students with disabilities into regular educational settings. It is a benefit to students with disabilities to be with their peers in the classroom.

Friend and Bursuck (2009) recognize the importance of social skills and state "The degree of success that any student can achieve in adulthood often is determined largely by his ability to effectively interact with others" (p. 482). Teachers need to give attention to helping all students learn social skills. These skills can be taught within the boundaries of academics similar to the skills taught using PECS in the Travis and Geiger (2010) study. Gaining a person's attention, turn taking, and using the names of communication partners are all examples of social skills. These results support the idea that implementing assistive technology, in this case, PECS, may be a benefit to students with disabilities. As students with disabilities increase their social interaction they also develop a better self-concept. They feel more confident and therefore attempt to be more independent.

Self-Management Benefits

Assistive technology has been shown to provide a greater sense of independence, performance benefits, and a significant decline in student anxiety levels (Morrison,

2007). The opportunity to access and utilize assistive technology allows students with disabilities to amplify their performance and accomplish tasks more efficiently and independently. Assistive technology may allow students with disabilities to complete tasks they could not otherwise attempt or achieve at all. Edyburn (2002b) linked assistive technology as an equity tool which has the potential to meet the needs of students with disabilities. Edyburn (2009) also acknowledged the fact that since five percent or less of students with disabilities are assistive technology users and thereby receiving these benefits, there is a long way to go to see assistive technology being implemented to see the maximum benefits dispersed to all students with disabilities.

In a study by Travis and Geiger (2010) discussed earlier in the access to learning benefits section, self-management benefits were reported in the findings. While a number of benefits were experienced by both students, self-management skills such as asking for help, gaining attention, making requests, making choices, taking turns and reciprocity were experienced (Travis & Geiger, 2010).

Mechling (2007) conducted a literature review focused on using assistive technology as "a self-management tool for persons with intellectual disabilities" (p. 252). The author identified forty studies which were conducted from 1990-2005 and categorized the results into four areas of research: pictorial prompts, tactile prompts, auditory prompts, and computer aided systems. The ability to self-initiate, self-instruct, self-maintain and self-monitor one's behavior are areas of concern for the ongoing desire to increase the independence level of people with disabilities. When the independence level is increased the need for continuous supervision is decreased.

In this literature review, Mechling (2007) itemized each of the forty studies, reporting the number of participants, the self-management skill or dependent variable, the design of the study, and a brief synopsis of the results. Results revealed 17 studies in which the assistive technology identified was picture prompts, eleven studies with audio cassette players, eleven studies with hand held computer based systems, and only one study with vibration. In regards to task completion, five studies were about task engagement, four studies about on task behavior, three about accuracy of task performance, two pertaining to initiation of tasks, two about transitioning between tasks, and one dealing with fluency of work performance (Mechling, 2007). "Each of the 40 identified studies reported positive results when using assistive technology as an antecedent prompt for eliciting a target response while reducing the need for instruction prompts" (p. 266). In particular, "twelve of the studies reported prompting strategies that guided and maintained performance over time" (p. 266).

Analysis

In summary, the literature review examined the many benefits assistive technology affords to students with disabilities. Technology is developing into an increasingly important part of the general and special education experience for students with disabilities. Assistive technology offers students a different way of looking at themselves and their capabilities, and it may help augment abilities and bypass or compensate for disabilities. The research reflects that students with disabilities may benefit by using assistive technology devices to foster academic success and independence and to compensate for reading, mathematics, writing, spelling, and other

difficulties (Bryant et al., 1998; Bryant & Seay, 1998; MacGregor & Pachuski, 1996). Students benefit through assistive technology devices and services by having more opportunities to interact or socialize, gain more experiences which provide background for knowledge, and have an increased sense of belonging. Assistive technology can stimulate curiosity and interest between peers. Students are intrigued when one of their peers with disabilities can operate sophisticated assistive technology devices. For the student with disabilities, assistive technology gives them a sense of self-worth and enhances their self-esteem when they are able to demonstrate to or teach their peers about technology. Teachers need to challenge themselves to explore assistive technology devices and services that will increase academic, social, and self-management benefits for students with disabilities. Assistive technology devices and services offer a variety of potential solutions for students with disabilities to compensate for their learning difficulties. Teachers need to look for opportunities to enhance these academic, social, or self-management benefits to effectively meet the needs of their students with disabilities. Teachers need to be cognizant of the learning, social, and self-management benefits obtained by students using assistive technology and utilize the rewards of these benefits as they plan, teach, and provide learning opportunities for students. This section of the literature review leaves us with questions to explore. Are teachers aware of these benefits assistive technology devices and services can foster? Is a teacher's consideration of assistive technology services and devices influenced by the benefits which could be provided to a student with disabilities? Does the teacher have the

resources available to provide assistive technology devices and services to a student with disabilities?

Teachers need to know there are many barriers to the successful implementation of assistive technology for students with disabilities. Assistive technology gives students with disabilities access to untried experience and, thus, students with special needs may feel empowered by assistive technology, which can prevent or remove barriers and enable them to gain more equitable access to successful learning experiences.

Barriers to Assistive Technology

While it is recognized that assistive technology can have a positive impact on a student's learning, a well-documented gap exists between the vision of the potential of assistive technology and the reality of a student with disabilities successfully accessing the general curriculum with assistive technology (Edyburn, 2000a, 2004; Morrison, 2007; Zabala et al., 2000). A number of barriers to the implementation of assistive technology have been identified (Derer et al., 1996; Lewis, 1998; Morrison, 2007; Todis, 1996). Identification of the proper assistive technology device, unrealistic outcome expectations, failure to replace or repair devices, budgetary constraints, and technical difficulties were barriers and issues reported in Todis' (1996) study. Derer et al. (1996) identified six barriers which accounted for 62% of the comments received from their study. The six barriers were as follows: (a) obtainability of equipment, (b) time management, (c) monetary expense, (d) monetary funds, (e) teacher knowledge, and (f) teacher training. Wehmeyer (1999) identified the following factors as barriers to assistive technology access and use: (a) lack of funding and/or high cost of the devices; (b) little information

available about products; (c) assessment/evaluation not available; (d) products unavailable; (e) device too complex for a person to use; (f) product upkeep too difficult; and (g) inadequate training for a person to learn to use the device.

While knowledge of assistive technology devices continues to increase dramatically, professionals are still apprehensive that assistive technology services have been overlooked (Edyburn, 2002a; Bausch & Ault, 2008). The professional literature reviewed for this study revealed many similarities in the identification of barriers in the effective identification and application of assistive technology in schools. A variety of terminology was associated with barriers by different professionals conducting research, but for this study barriers to assistive technology will be categorized into fiscal restraints, limitations of teacher knowledge, equipment, and abandonment.

Fiscal Restraints

When teachers were first required to look at assistive technology services for students with disabilities, many were concerned that the cost of assistive technology was a barrier. However, these concerns may have decreased recently due to greater affordability and yet recent data regarding cost are not available (D. L. Edyburn, personal communication, November 21, 2011). Further some scholars propose that cost is a greater restriction today than it was a decade ago (K. Higgins, personal communication, November 21, 2011). It is difficult to conclude whether cost is a prohibitive factor or if the provision of assistive technology to students with disabilities is more affordable today. In this literature review fiscal restraints will be discussed as a barrier in terms of

purchasing, maintaining and repairing assistive technology devices and the cost of providing assistive technology services.

Derer et al. (1996) initiated a project, The Analysis of Technology Assistance for Children (ATAC), to address the absence of information pertaining to current practices of assistive technology. Within this project they developed a survey and distributed it to special education classrooms across three states: Indiana, Kentucky, and Tennessee. This survey was developed and refined using previous questionnaires from the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) and Tennessee Department of Human Services, periodicals, and assistive technology textbooks. The final version of this survey was narrowed to 75 items including "13 items related to the demographics about respondents and characteristics of their students using assistive technology, two open-ended items asking respondents to identify the barriers and benefits of using assistive technology, and a set of 63 items that requested information on the number of students using different types of assistive technology devices in various settings" (Derer et al., 1996, p. 2). A total of 1266 surveys were distributed to districts that were actively providing assistive technology services. Of these 1266 surveys sent, 405 were returned for a 32 percent return rate. Information regarding barriers was identified from responses to the first open-ended question on the survey. The results were analyzed and coded with a scoring taxonomy. "By far the most frequently mentioned barrier involved monetary concerns" (p. 5). Expense and lack of funds were two identified sub-themes within monetary concerns reported by special educators. Expense referred to "expense of acquiring equipment related to the fees, cost,

and price of hardware and software" (p. 5). The lack of funds was identified as "access to an adequate money supply for purchasing equipment, training, or personnel" (p. 5).

Accurate assessment and knowledge of the assistive technology continuum provides the basis for making cost-effective assistive technology decisions (Beard et al., 2011). "For students who are eligible for special education services under one of the 13 disability categories defined by the Individuals with Disabilities Education Act, it is the responsibility of the local school district to pay for any AT device or service included in the student's IEP" (Beard et al., 2011, p. 12). Outside funding is usually necessary but limited and difficult to secure for the required assistive technology devices.

Wehmeyer (1999) discussed assistive technology barriers identified in the study completed by The Arc. The Arc created the Assistive Technology Use Survey and mailed it to 5,400 randomly selected members of The Arc who had a family member with mental retardation. The survey was designed to be completed by a parent or caregiver. A response rate of 33% was achieved equaling 1,802 completed surveys returned. "The sample included 516 family members (or other adults knowledgeable about the assistive technology use of someone with mental retardation) from 45 states and the District of Columbia who returned completed surveys" (p. 49). The range of age for these students was from 1 to 21 years with a mean age of 11.84. There were 314 males, 200 females, and two surveys did not have the gender section completed.

> Forty-eight respondents indicated that their family member lived elsewhere including with another parent (n = 4), in a foster home (n = 1), in a supervised group home (n = 13), with another relative (n = 6). Eighteen respondents indicated that their family member resided outside the family home, but didn't identify that location or listed "other," and 4 respondents didn't indicate where their family member resided. (p. 50)

The final survey contained five areas of questions concentrating on the use of assistive technology for a specific purpose: (1) Mobility Technology Devices; (2) Hearing and Vision Technology Devices; (3) Communication Technology Devices; (4) Home Adaptations; and (5) Environmental Control and Independent Living Devices (Wehmeyer, 1999). Within each of these five areas, there were identical questions pertaining to the domain area. The researchers asked if the student with disabilities used a device and provided a list to pick the particular device. The survey contained one question each about the funding source, assessment before and after purchasing the device, and satisfaction rate.

The other area included on the survey was designed to collect information on the availability of a computer in their home, if the computer was specifically purchased for the student with a disability, the funding source of the computer, and the purpose or intent of the use of the computer. If the student with disabilities did not have a computer available, in any environment, the respondent was asked to determine if that student could benefit from the use of a computer and the relevant barriers to computer access.

In The Arc's study, the respondents identified cost as the number one barrier to use of an assistive technology device. Cost was the barrier reported on in 255 of the possible responses.

Wehmeyer (1999) compared the Derer et al. (1996) survey, discussed earlier in this literature review, to The Arc survey and determined the results were quite similar. Derer et al. identified one of his six barriers of assistive technology as fiscal restraints, including the high cost of devices and the lack of funds to access devices or service.

Fiscal restraints are a continuous problem in the area of assistive technology, "as data from both this survey and the Derer et al. study strongly support" (Wehmeyer, 1999, p.52). The contentious issue of who pays for the assistive technology often creates conflict between school districts, teachers, and parents. These participants will need to work together to resolve the barrier of cost as it pertains to assistive technology.

Stead (2009) identified cost as a barrier. Stead supports this with a discussion of legislative acts. He suggests the IDEA requirement that students with disabilities be educated with their non-disabled peers to the maximum extent possible is a "clear legal imperative to make assistive technology available" (p. 2). He also concurs "current laws, in particular the Individuals with Disabilities Act (IDEA), require that most assistive technology devices be provided free of charge to students with disabilities, if the devices are necessary for their education" (p. 2). Stead (2009) argues that despite these legal implications, assistive technology remains underutilized in American public education. He rationalizes his claim that cost is a barrier by lack of funding of legislative acts with this statement: "Another obstacle to the full utilization of assistive technology that cannot be overlooked is that neither the IDEA, nor the NCLB (No Child Left Behind Act) has been fully funded" (p. 2). This lack of funding has compromised the ability to provide assistive technology devices and services to students with disabilities who could benefit from these appropriate assistive technologies and it also enhances the reluctance to adopt technology that would require the purchase of new assistive technology equipment.

Lee and Vega (2005) designed a study to "assess perceived knowledge, attitudes, and challenges of assistive technology use by special education teachers in California" (p.

60). A survey of 4 multiple-choice questions, 15 open-ended items, and 20 Likert-scale items was distributed to 599 special education personnel in a mostly rural county with a high migrant population in California. This county has one of the largest school districts in the state and is also characterized by the lowest median income levels and highest unemployment levels in the state. Five hundred ninety-nine questionnaires were sent, and 154 valid responses were returned for a 26% return rate. Of these 154 responses, 23 (16%) respondents mentioned the funding issue. This could be attributed to being indirectly related to the lack of resources and materials, which was mentioned in 19% of the responses. In summary, "In times of tight budgets and economic hardship, this (funding assistive technology) will continue to be one of the biggest challenges to assistive technology in special education classrooms" (p. 61).

Hasselbring and Glaser (2000) noted financial issues in school districts acted as substantial barriers to the incorporation of assistive technology. Schools are often hesitant to provide assistive technology, and teachers of students with disabilities must seek out alternative funding. To complicate funding as a barrier, Hasselbring and Glaser (2000) discussed the factor that assistive technology devices are often specific to an individual. Each individual's needs are different and unique requiring an individualized assistive technology device. This individualization drives the cost higher.

Hutinger et al. (1996) conducted a case study that analyzed how assistive technology was used in educational programs for 14 children with multiple disabilities. All 14 of these children had had two to ten years of prior assistive technology use and had received assistive technology intervention as a young child. All 14 of the children

had regular access to assistive technology and all attended school in eleven districts in western Illinois which ranged in size from 60 to 7,960.

The authors used direct observation, videotapes of the children, questionnaires, and interviews with the teachers and parents to collect data. They also incorporated data pertaining to previous use of assistive technology to create a comprehensive picture of technology use and its impact. The investigators used a modified longitudinal approach which "permitted the study of changes in behavior, skills, and attitudes occurring in the children as they continued through school" (Hutinger et al., 1996, p. 16).

One of the barriers identified in this study by staff and family members was financial resources. Results from the study showed that limited finances negatively impacted technology use in the following ways: "(a) inadequate support services; (b) inadequate funding for media and materials; (c) inadequate classroom equipment; and (d) inadequate classroom staffing" (Hutinger et al., 1996, p. 31).

Respondents also referred to the hope and excitement of what their child could possibly accomplish based on the assistive technology assessment that was conducted. This hope did not last long as they also commented the process was long and the paperwork was endless with little results. Another monetary barrier reported in this study was when parents tried to secure funding for assistive technology from public agencies they did not get satisfactory results. One mother commented "I tried all last year through organizations with no success" (Hutinger, et al., 1996, p.31).

In a majority of empirical studies, fiscal restraints were identified as a barrier. Korpela, Siirtola, and Koivikko (1992) conducted a study to "evaluate the costs of

assistive devises regionally in a group of children with mobility limitations" (p. 597). Assistive technology devices for home, school, and day care settings were included in this study.

The study took place in Finland with 201 children with motor limitations who lived at home and had assistive technology devices. The mean age of the students in the study group was 7.4 years of age. There were 89 girls and 112 boys.

The results of the Korpela et al. (1992) study revealed the children in this study utilized 1274 assistive devices which had a total cost of $686,666. The results of this study led the authors to suggest "the assistive devices were relatively expensive compared to incomes of Finnish families" (p. 601). The study did report the cost of the assistive devices was the most dependent on the "the severity of motor impairment and the age of the child" (p. 601). The inhibitive costs revealed in this study lend support to the claim of the cost of an assistive technology device can be a barrier to successful implementation of such devices.

The data reported and the findings discussed in this literature review outline the concept that costs of purchasing, training, and maintenance or repair of assistive technology devices are barriers to providing effective assistive technology to students with disabilities. This may no longer be an issue, they may be more affordable, however, recent data regarding costs are simply not available. In fact, some scholars may conclude that cost may be a bigger barrier than it was ten years ago. It is difficult to ascertain whether assistive technology is more affordable today than it was or if cost is still a factor.

Limited Teacher Knowledge

The literature pertaining to the competencies of a special educator's knowledge of assistive technology is "almost universally in agreement that the success of students with disabilities with AT is related directly to the AT knowledge, skills, and dispositions of special education teachers" (Michaels & McDermott, 2003, p. 29). In this literature review limited teacher knowledge as a barrier will be categorized in the areas of teacher awareness and the attitude and acceptance level of teachers as they pertain to assistive technology.

Teacher awareness. As more students with disabilities are participating in full inclusive classrooms, in which they are expected to perform grade-level work but are not always given support, teachers are continually exploring ways to educate students with disabilities more effectively. Assistive technology is one of the tools and strategies that teachers can utilize, yet too many teachers are not cognizant of the potential of assistive technology to empower students who are struggling to work independently at their grade level (Hasselbring & Bausch, 2005). Based on the available literature, it appears that a teacher's knowledge or lack of knowledge regarding assistive technology could be classified as a significant barrier to the successful implementation of assistive technology.

Van Laarhoven et al. (2008) conducted a study which "involved evaluation of pre-service teachers' knowledge of, and comfort with, using AT and integrating a prototype computer-based DVD-Encyclopedia of AT (EAT) – into instruction" (p. 31).

A total of 188 pre-service special and elementary education teachers participated in the study at the Northern Illinois University (NIU) in 2006. The pre-service teachers in this study were all juniors or seniors and enrolled in one of the four targeted education courses.

An Encyclopedia of Assistive Technology (EAT) was prepared in DVD format to utilize in this study. This EAT contained tutorials comprised of "videos depicting software programs and/or devices that support individuals who have difficulties with written language, reading, math, communication, study skills, and/or physical control of their environment" (Van Laarhoven et al., 2008, p. 34). The students were required to watch the EAT DVD in class or in the assistive tech lab and complete the required components of each lesson. The goals of the study were to measure if the use of the EAT was an effective method for incorporating assistive technology into the teacher education program and "to determine if teacher candidates' familiarity, comfort level, and perceived effectiveness in AT improved as a result of using the tutorials" (p. 37). Teacher candidates were also asked to evaluate the EAT tutorials regarding their "satisfaction with using video based materials as an instructional tool" (p. 37).

To measure the effects of the EAT the teacher candidates were given a 40 statement field tested survey as a pretest and posttest. On each statement the students were asked to rate their level of agreement using a 5-point scale. Four major subscales were created to analyze the results from the survey. A second survey that was a 10-item rating scale was used to measure teacher candidates' satisfaction with the video tutorials. Three major subscales were used to analyze the results from the second survey.

The authors reported the results of the study (Van Laarhoven et al., 2008) using a partial eta-squared (as cited in Cohen, 1988) to measure the magnitude of growth from pretest to posttest. All of the results from the subscales showed significant pretest and posttest differences. The study results support the suggestion that a teacher's knowledge or awareness is a barrier to the effective use of assistive technology by a student with a disability. The personnel of this University, NIU, recognized a lack of experience or training with assistive technology as a deficit in their teacher education program and developed a resource to fill this void, with expectations to better prepare teachers to identify, implement, and evaluate the use of assistive technology with their students.

Bausch et al. (2008) conducted a study to "describe the current state of AT service delivery as reported by teachers in 14 states" (p. 3). A survey design was implemented in this study to collect data. The Status of AT Use Survey was developed by National Assistive Technology Research Institute (NATRI) researchers which "contained six sections that asked respondents to report data on student demographics, educational placement, AT use, AT services, related services, and AT documentation" (p. 4). The survey was available in a paper and online version.

The section of the survey pertaining to this Bausch et al. (2008) study was where respondents were asked to list the assistive technology services which their students received. Following the identification of services, respondents were asked to "indicate whether the service was provided by a school system employee or a contracted professional" (p. 5).

A total of 699 surveys were completed from a variety of sources, including respondents from 14 states who were participating in a simultaneous NATRI study, six school districts, and attendees at various national conferences. The surveys completed reflected students with various disabilities, and 468 students were male, 225 students were female, with gender not identified in six surveys. The students were in grades preschool through twelfth. Of the 699 returned surveys, 110 respondents reported the student did not receive any assistive technology services. Since respondents could enter all services a student was receiving, there were 1468 assistive technology services recorded on the remaining 589 surveys.

The findings in this study by Bausch et al. (2008) rose "concerns about the lack of awareness among professional of what AT services are" (p. 11). While much effort has been made to "educate professionals about the nature of AT devices, successful implementation of technology depends on the provision of services" (p. 11). An alarming fact apparent from the findings in the study was 110 out of the 699 students were reported to be using assistive technology devices but they did not receive any assistive technology services. "Such a trend is alarming, because successful implementation of AT devices is not possible without the support of AT services" (p. 11). Assistive technology services are legally required to be documented in a student's Individual Education Plan (IEP). It is crucial that educators are knowledgeable of the requirement to consider appropriate services along with the devices during the IEP process. This lack of awareness may interfere with assistive technology services delivery and successful implementation. Assistive technology must be documented in the

IEP but this cannot happen if IEP team members are unaware of assistive technology devices and services (Bausch et al., 2008).

The implications of the Bausch et al. (2008) study have an important message for both professionals working with students with disabilities and for teacher education preparation programs. The obstacle of limited knowledge pertaining to assistive technology services must be overcome and solutions determined to eliminate teacher knowledge as a significant barrier to effective utilization of assistive technology.

In the case study by Hutinger et al. (1996), as discussed previously, a lack of training regarding assistive technology is identified as a barrier. Teachers may know that assistive technology should be considered for a child as part of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA, 2004), but being able to implement assistive technology into daily schedules and the curriculum necessitates a unique set of skills. Training for teachers on different technologies and strategies to integrate those technologies into the curriculum would have the potential to impact children's learning. Many teachers who do not use technology to its full extent identify lack of time and lack of awareness of training opportunities as the cause.

A study conducted by Michaels and McDermott (2003) was designed to measure the level of integration of assistive technology into curriculum and instruction of special education teacher preparation programs. A survey was designed to collect the desired data. The authors' two research questions in this descriptive study were "how are knowledge, skills, and dispositions related to AT currently integrated within special education teacher preparation programs; and how should knowledge, skills, and

dispositions related to AT ideally be integrated within special education teacher preparation programs" (p. 30). The respondents to this survey were program coordinators of graduate special education teacher preparation programs across the country. Surveys were mailed to 356 program coordinators. The survey instrument, Special Education Teacher Preparation Survey, was developed to collect both quantitative and qualitative data. The survey was divided into three major sections. The first section was to report demographic information. The second section consisted of two 7-point Likert scales, which share the same 22 items. The first 7-point scale measured the "current attainment level or the degree to which the item was currently being addressed with their special education teacher preparation program" (p. 31) and the second 7- point scale pertained to attitude and acceptance levels of special education teachers and will be discussed later in this section. The final section of the survey was to gather narrative answers to these two open-ended statements: "Describe how AT knowledge, skills, and dispositions were currently addressed within their special education graduate program" and "Describe any planned future changes, or enhancements to promote AT knowledge, skills, and dispositions" (p.31). These three components or factors associated with assistive technology competencies were addressed in this survey: understanding of assistive technology; using assistive technology; and making assistive technology decisions.

There were 356 surveys mailed to respondents and 143 of these surveys were returned for a 40 percent response rate (Michaels & McDermott, 2003). The respondents were 66 % female, white, middle aged, and had been employed in their jobs

approximately ten years on average. The data reported by respondents when asked to describe their current level of assistive technology knowledge was 57 % intermediate, 24% novice, and 5% no experience. The analyses of quantitative data on the survey pertaining to "the degree to which AT competencies are currently integrated and addressed within graduate special education teacher preparation programs" (p. 33) can best be interpreted as minimal or not at an acceptable level of attainment. Special education teacher preparation programs must increase "capacity, resources, and faculty expertise so they can effectively integrate AT competencies into curriculum and instruction to assure their graduates leave their teacher education programs with the knowledge, skills, and dispositions necessary to address the AT needs of their students" (pp. 38-39).

Michael's and McDermott's (2003) recommendations will need to be considered by many teacher education preparation programs if the goal is to ensure all teachers of students with disabilities are competent in their knowledge of assistive technology devices and services. This will be "especially critical as new technologies are developed that hold great promise for improving the independence, productivity, and full participation of people with disabilities in school and society" (p. 39).

Puckett (2004) reported on a project to develop an assistive technology toolkit for special education teachers. The project was called Accessing Curriculum Content for Special Education Students (ACCESS) and was conducted with thirty-one K-8 special education teachers. The teachers were from thirteen schools in five different districts.

A survey, which yielded results of particular concern, was completed by the participants prior to the start of the intervention, of an on-line training. The survey indicated, "Extremely low levels of knowledge and use of assistive technology reported prior to the project activities" (p. 10). The results of this study supported the claim of low level of teacher awareness concerning assistive technology is a barrier to students' effective use of assistive technology. The beginning level of knowledge for teachers of students with disabilities can hinder the students' access to the general education curriculum.

Thompson et al. (2000) stated, "Special educators who are expert problem solvers rely on a variety of tools and strategies, including assistive technology in their work" (p. 12). The authors acknowledged assistive technology is not the answer to every challenge that students with disabilities encounter; however, special educators who have "little knowledge and/or limited access to them are at risk of becoming ineffective" (p.12). Special educators who do not possess current knowledge of assistive technology are at a disadvantage to "participate meaningfully in solving certain types of problems" (p. 12). The authors gave the example of a teacher who is unaware of computer screen magnification technology would see no value in introducing a student with a severe visual impairment to the advantages a computer could provide. "The uninformed teacher may reason that devoting time and energy to teaching computer skills to a child who cannot see the screen or the keyboard would be as futile as enrolling the child in a behind the wheel driver education course" (p. 12). The lack of computer skills may limit this child's opportunities for future learning.

Thompson et al. (2000) did not put all the responsibility of the lack of assistive technology knowledge on teachers. They suggested "local school districts, state education systems, and the federal government could certainly have done more to provide opportunities for teachers to upgrade their skills" (p.13) along with teacher preparation programs and the individual teacher.

Illinois State University (ISU) engaged in an initiative to improve the assistive technology knowledge of special education teachers. At the beginning of this initiative a survey was created to "determine (a) the extent to which they perceived that their students had unmet needs for AT, (b) what they perceived to be their needs for AT competencies and training, (c) what features they would like to have incorporated into a regional AT Center, and (d) how they would like to have AT training provided" (p. 13). The information gathered in response to section (b) what they perceived to be their needs for AT competencies and training, is significant.

The survey was mailed to 234 special educators employed by three administrative units close to the ISU campus: "(a) the University's two laboratory schools; (b) a special education association that serves 17 rural school districts; and (c) a special education association that primarily serves students who live within the boundaries of a mid-sized city" (Thompson et al., 2000, p. 13). ISU had 149 surveys returned for a 64% response rate. The special educators were given a list of seven barriers and asked to "assess the extent to which each of the barriers had an actual impact on service provision" (p. 15). The results of this assessment were equally distributed. The barrier "A lack of knowledge about the potential of assistive technologies to benefit students among school

personnel" (p. 16) had 45% of respondents indicating it was a legitimate barrier and 19% indicating it was a major barrier, the highest percentages reported on any of the potential barriers.

The special educators also were asked to assess their general competence in assistive technology. Seven percent of respondents were very competent, 56% some competence, and 37% reported they lacked basic competence. Thompson et al. (2000) stated the data, "suggests a great need for additional pre-service and in-service training of teachers in assistive technology" (p. 17). The authors emphasized: "It is not a challenge, but rather a morale mandate, that we determine students' needs for AT and prepare our teachers to respond to them" (p. 21).

Even though this survey was specific to the region around ISU, it does support the claim that lack of teachers' knowledge is a significant barrier to effective utilization of assistive technology by a student with a disability. ISU recognized the void of knowledge pertaining to assistive technology in their special education teacher preparation program and initiated a process to eliminate this barrier, which many other universities could replicate.

A study by Lee and Vega (2005), as discussed earlier in this literature review, was designed to "assess perceived knowledge, attitudes, and challenges of assistive technology use by special education teachers in California" (p. 60). This was a survey of four multiple-choice questions, 15 open-ended items, and 20 Likert-scale items which was distributed to 599 special education personnel in a mostly rural county with a high migrant population in California. The data collected reflected the largest barrier to

assistive technology use was a lack of knowledge or awareness (N = 58; 41%) by teachers. The authors included several quotes from the respondents in their study: "The challenges/barriers were learning how to use the devices; knowledge of possible AT beyond academic skill development; I am not aware of what other AT is available; and lack of knowledge on my part" (p. 61).

Judge and Simms (2009) conducted a descriptive study of special education teacher preparation programs to analyze the current practice of assistive technology course delivery for the preparation of special educators. The authors identified 375 publicly funded institutions offering special education teacher preparation programs. They narrowed their search to 160 preparation programs which represented urban, suburban, and rural areas from across the United States. "Of the 160 postsecondary institutions sampled, there were 819 different programs offered at the undergraduate, initial licensure post baccalaureate, and master's degree level" (p. 37).The results of this study revealed interesting data. "Of the 185 different undergraduate licensure programs offered, 34.6% mandate an AT course for degree and licensure requirements" (p. 38). Three hundred sixteen postsecondary institutions offered a special education initial certification program for students already holding an undergraduate degree. Of these 316 "programs offered, 28% mandated an AT course for initial licensure requirements" (p. 38). Approximately 96% of the 819 programs offered a master's degree in special education. Of the master's programs 24.1% mandated an assistive technology course for degree requirements. Only two degree programs required students to complete two courses pertaining to assistive technology. Data from Judge and Sims (2009) suggested

that if assistive technology coursework was required in a special education licensure program, such coursework typically involved only one assistive technology course. These findings seemed to indicate a lack of assistive technology training at the preservice level (Judge & Sims, 2009).

Limitations were identified in this study which would need to be considered before generalization could happen. This study by Judge and Simms (2009) seems to support the claim that lack of a teacher's awareness or knowledge can be a barrier to a student receiving appropriate assistive technology services and devices thereby hindering the student's progress.

Hanline (2010) conducted a qualitative study with 15 early childhood special education (ECSE) pre-service teachers in Florida to acquire insight to the relationship of the "conceptual and theoretical knowledge gained in the academic classroom to the realities of providing early intervention services" (p. 349). The 15 teachers were female. One was African American, one Hispanic, and 13 Caucasian. All 15 participants had progressed through an accredited (National Council for Accreditation of Teacher Education) special education initial teacher certification program. This program included one class pertaining to assistive technology entitled "Introduction to Special Education Technology" (Hanline, p. 338). "When participating in the field experience for the purpose of this study, the pre-service teachers were in their master's year of a combined junior-senior initial teacher preparation program, but data were not analyzed until each participant graduated" (Hanline, p.336). All 15 pre-service teachers were placed with appropriately certified cooperating teachers in one of seven preschool "settings that

included in the same classroom 3- to 5- year olds who were typically developing, at risk, or identified as having disabilities and/or developmental delays" (p. 336). The participants were required to complete all the components of teaching in an inclusive preschool special education classroom. "In addition, they were required to submit weekly reflective journals, participate in bimonthly seminars, and evaluate the course at the end of the semester" (Hanline, p. 338). The participants were each individually observed three times for an hour each time. Following the observation, the university supervisor would provide oral and written feedback.

The data collected were the weekly reflective journal entries, the questions asked or experiences shared during observations, and the final reflection regarding the level of supervision they were provided. Out of the 182 completed journal entries from a possible 195 entries, 135 questions were asked, 42 experiences were shared, and 15 comments during the final reflection were the data coded and analyzed. Hanline (2010) used the Department of Early Childhood (DEC) recommended practice strands in early intervention/ECSE as a starter list of codes. These direct strands included: assessment; child-focused practices; family-based practices; interdisciplinary models; and technology applications.

The one significant piece of information from the Hanline (2010) study that pertains to this study is absence of data to be coded into the DEC strand of technological applications. "In this study, pre-service teachers wrote and spoke *minimally* about technology applications and interdisciplinary models (both direct service strands) having had little experience with either in their field experiences" (p. 348). DEC supports the

personnel preparation recommended practices that "students need opportunities to practice research-based instructional strategies with individuals, small groups, and large groups in the service site" (Miller, Ostrosky et al., 2003, p.113, as cited in Hanline, 2010). These pre-service teachers did not have an opportunity to practice with assistive technology, creating a void in the pre-service teachers' application of knowledge pertaining to assistive technology. Hanline (2010) reported "It is critical that the ECSE personnel programs continue to strive to provide field experiences that mirror the breadth and depth of the role of the ECSE professional" (p. 348). Implementing necessary and effective assistive technology services to preschool students with disabilities would qualify as a role of the ECSE professional.

A field experience is an "opportunity for pre-service teachers to connect the conceptual and theoretical knowledge gained in the academic classroom to the realities of providing early intervention services" (p. 349). The lack of data to be categorized in the DEC strand of technological applications reflects the lack of conceptual and theoretical knowledge gained in the academic classroom pertaining to technology applications, including assistive technology, which can be applied to the realities of providing early intervention services. The implications from this Hanline (2010) study support the claim that all teachers lack the training to supply the necessary and effective assistive technology devices and services to student with disabilities.

The Arc study reported by Wehmeyer (1999) as discussed earlier in this literature review, identified cost as the number one barrier of assistive technology, but found a

teacher's deficit of information or a lack of knowledge pertaining to assistive technology as the second most identified barrier.

> These results, in conjunction with findings from Derer and colleagues, suggest that tech is generally perceived to be beneficial but barriers like funding and lack of information fail to bridge the gap between the promise of assistive technology articulated in the Tech Act and reality of identifying, obtaining, and using such devices...The challenge for districts, teachers, families, governmental bodies alike will be to find creative ways to make the promise a reality. (p. 55)

Nelson (2006) conveys the idea that educational needs of P-12 students are at the center of the Interstate New Teacher Assessment and Support Consortium (INTASC) standards and the National Council for Accreditation of Teacher Education (NCATE) guidelines. INTASC standards make "specific reference to diverse learners, the use of technology, and the availability of a variety of materials, approaches, and opportunities to demonstrate knowledge for P-12 students" (p. 486). In response to meeting these educational needs of P-12 students, Nelson (2006) stated "The knowledge, disposition, and teaching performance or skills needed to embed AT in teaching and learning should be a necessary and beneficial part of meeting the standards for all teacher candidates" (p. 496). Although, he recognized these components of knowledge, disposition, and teaching performance or skills as related to assistive technology are not always present to embed assistive technology into instruction for students with disabilities. Nelson (2006) quoted these 1999-2000 statistics from the U.S. Department of Education:

> 87.5% of students with speech or language impairments, 45.3% of students with specific learning disabilities, 25.8% of students with emotional disturbance, 14.1% of students with mental retardation, and 11.2% of students with multiple disabilities were served outside the regular classroom less than 21% of the school day. (p. 486)

These statistics reflect the fact that students with disabilities are in the general education classroom 79% or more of their day. Many of these students may benefit from the use of an assistive technology device and teachers and teacher candidates "need to be prepared to recommend and utilize innovative technologies which bridge many of the learning gaps for students with special needs" (Nelson, 2006, p. 486). Nelson (2006) acknowledged that teacher education programs today needed to reform and include a background of a range of assistive technology devices and services, legal parameters of the provision and use of assistive technology, and consideration of assistive technology in the IEP process. These statements reflect the claim that teachers lack the training to supply the necessary and effective assistive technology devices and services to meet the needs of their students with disabilities.

The assessment or screening of an individual to match an individual with the most beneficial assistive technology device was an important part of the reauthorization of IDEA (1997). If the screening is appropriate and adequate, it will be a crucial support tool in the path to greater independence and integration into the world for a student with disabilities. If the special education teacher does not have the knowledge to conduct this screening, or has resistance to initiating this screening, the assessment becomes a barrier to successful implementation of assistive technology to students with disabilities.

Beigel (2000) identified the concept the learner's strengths and abilities must be kept as the overarching objective during the assessment phase. The strengths and abilities must to be used "to ameliorate potential difficulties in the classroom" (p. 239). He cautioned it is easy to get absorbed in extravagant assistive technology devices and lose

focus on determining what "strengths the learner has and how the use of AT might enhance these strengths to enhance the educational outcomes for the learner" (p. 239). Beigel (2000) broke the assessment process down into three strands: the learners, their environment, and the technology. He stated the three strands are directly connected in the following way: "The learner must use the device in many environments. Failure to consider any one of these areas may lead to a failed evaluation, as the device prescribed may be abandoned" (p. 239). The teacher is the key component in all three of these strands. If the teacher is unaware of all the details that configure these three strands the teacher would be considered the barrier in the assessment process.

Beigel (2000) stated the learner's personal style and the learner's physical strengths and needs are the two general areas pertaining to the individual action of a learner abandoning a device. Determining, or screening for, the learner's personal style involves spending substantial time with the learner to explore their preference of the device. He identified a set of questions for each of the three strands of the assessment process. He stated the following questions needed to be addressed with the learner at the beginning of the assessment process:

> (a) What purposeful motoric movement does the individual have; (b) How willing is the learner in trying new activities or tasks; (c) What does the learner desire from the use of AT; (d) What supports will the learner require in using the device; (e) What level of training will the learner and others who interact with the learner need; and (f) What impact will the learner's socioeconomic status and cultural background have on the use of AT? (p. 240)

In the second strand, the environment, Beigel (2000) identified questions regarding how the teachers present information to learners, what is the preferred learning style, what type of assessment is used, and what is the teacher's level of receptiveness of

a student utilizing assistive technology in the classroom. The physical structure of the classroom was also explored.

Beigel (2000) cautioned that the third strand, the device, should only be scrutinized after examining the learner and the environment. Beigel (2000) offered questions for examining the device and checking for durability, for ease of repair, and for portability of the assistive technology.

Beigel (2000) discussed each of the questions in detail reiterating the importance of the teacher's role in the assessment phase to select the assistive technology device which will enhance the interactions and learning and "allow learners to use their strengths and participate as fully as possible in the school" (p. 239).

Beigel's (2000) questions are very similar to Zabala's et al. (2000) Student, Environment, Tasks, and assistive Technology tools (SETT) framework. The SETT framework provides broad questions that help Individual Education Plan teams to focus on individual student needs in multiple environments.

Abner and Lahm (2002) conducted a study using a census survey to identify teachers' lack of training. This survey was mailed to all teachers of students with visual impairments in Kentucky. Of the 145 surveys mailed out 72 were from which data were collected. Sixty eight of these 72 respondents were certified teachers of students with visual impairments; the other four were currently enrolled in a certification training program.

Abner and Lahm (2002) cited this statement from the International Society of Technology in Education, (2000): "A critical factor in students' use of technology is their

teachers' technological knowledge and skills" (p. 101). A majority of teachers (51%) in this study felt they were at the apprentice or lower level for teaching their students regarding assistive technology. When the teachers in Abner and Lahm's (2002) study were asked if they felt they needed more training in assistive technology, 70 of the 72 (99%) responded with a "yes" answer. The authors summarized their finding with this statement: "On the basis of these findings, it is clear that university training and other professional development programs should address competence in higher-level technology" (p. 104) knowledge and skills for teachers of students with disabilities.

This study strengthens the argument that a teacher's knowledge or lack of knowledge regarding assistive technology could be identified as a significant barrier to the successful implementation of assistive technology. This deficit of knowledge will impact a teacher's ability to screen students for assistive technology devices and services. Complicating the knowledge barrier are attitudinal and acceptability factors also restricting the successful implementation of assistive technology. In addition, teachers do not know there are attitude and acceptance issues. The level of knowledge may also hinder the attitude and acceptance level of assistive technology by a teacher which will be reflected as a barrier to successful implementation of assistive technology

Attitude and acceptance. A study conducted by Maushak, Kelley, and Blodgett (2001) supported the statement that teachers' attitudes and acceptance levels could be barriers to use of assistive technology by a student with disabilities. This study involved 168 students enrolled in a computer applications class for elementary teachers. A 20-question survey was "designed to measure students' knowledge of and attitudes toward

assistive technology and students with disabilities" (p. 270). The participants used a six-item Likert scale as a response set. Participants were asked to indicate if they had any of the following three variables: (a) completed the required diversity course; (b) had a family member who is disabled; or (c) had a close friend who is disabled. This study used a pre-post-survey design format with 168 students completing the pre-survey and 154 students completing the post-survey. The age range of the students was from 19 to 44 years with an average age of 21.3 and 85% of the participants were females.

A mini workshop on assistive technology was presented to the student participants between the pre-survey and the post-survey. The data collected in the study by Maushak et al. (2001) were analyzed three ways. The pre-survey frequencies were studied "to identify current attitude and knowledge and identify areas of concern" (p 270). The data was then reviewed for the post-survey to check "if the same areas of concern held true after participants completed the mini-workshop" (p. 270). The third way data was analyzed was to compare the mean scores of the pre- and post-survey to detect any differences in the "attitudes and knowledge based on independent variables: diversity class, disabled friend, and disabled family member" (p. 270). The results of the study reflected varying attitudes of the pre-service teachers towards acceptance of students with disabilities and their use of assistive technology as an access to the general education curriculum and setting. One area of concern was almost three-fourths of the participants felt students with disabilities should be in a special school. Another troubling result from this study was that "over one-third felt that children in a traditional classroom would be uncomfortable with a disabled child and that disabled children feel

sorry for themselves" (p. 273). Even the students who had completed the diversity class communicated these feelings in their survey results. The students' survey results indicated that students did have at least an awareness of assistive technology but they did not feel it was an acceptable intervention for students with disabilities to participate in the general education environment.

The impact of the mini workshop did not foster a change in attitude but it did increase the knowledge level pertaining to assistive technology (Maushak et al., 2001). These results support the need for the inclusion of assistive technology to be immersed in the teacher education preparation program. The results also suggest the content of the diversity class be restructured to raise the awareness and acceptance of students with disabilities in all environments. This study supports the statement that a teacher's attitude and acceptance level can have an impact on how well assistive technology is identified and implemented for a student with disabilities.

Michaels and McDermott (2003), in a study referenced earlier, used Likert scales to measure data from teachers of students with disabilities. The second 7-point scale "asked respondents to consider the importance or how critical they believed that knowledge, skills, and dispositions related to that item would be for special education teachers in relation to promoting the full citizenship of students with disabilities" (p. 31). Statistically significant and substantially meaningful differences between the perceived current attainment and importance of assistive technology integration were reported in this study. These "differences between the perceived current attainment and importance of this AT integration would seem to indicate that many current graduates are leaving

graduate special education teacher preparation programs without these critical AT competencies" (p. 39).

Michaels and McDermott (2003) reported some of the graduate programs in special education included in this study commented that assistive technology knowledge, skills, and dispositions were not necessary in their programs as they were preparing educators to work with students with mild or higher incidence disabilities. Michaels and McDermott (2003) cited National Association of State Directors of Special Education (2002) and Research Connections (1998) as a rebuttal of this statement:

> Evidence indicates that the successful inclusion of students with mild or high incidence disabilities and their ability to access the general curriculum and demonstrate mastery of the ever-increasing state and national learning standards may be directly related to effective AT integration in the programmatic preparation and instruction of special education teachers at the pre-service level. (p.39)

A study by Lee and Vega (2005), as discussed earlier in this literature review, was designed to "assess perceived knowledge, attitudes, and challenges of assistive technology use by special education teachers in California" (p. 60). This was a survey of 4 multiple-choice questions, 15 open-ended items, and 20 Likert-scale items distributed to 599 special education personnel in a mostly rural county with a high migrant population in California. The results indicated that teachers who reported receiving more training hours pertaining to assistive technology also had a higher acceptance level of students with disabilities using assistive technology and the importance of assistive technology.

The teacher plays a critical role in the success or failure that assistive technology can play in the life of a student with disabilities. Early childhood and elementary

teachers play a critical role to provide assistive technology devices and services at an early age. Early implementation of assistive technology has shown to influence children's attainment of developmental skills (Parette & Stoner, 2008). Individual education program (IEP) team members are mandated under IDEA (2004) to consider assistive technology for every student when developing IEPs. The research reviewed in this section confirms that teachers at all levels are generally unaware of assistive technology devices and services or may possess attitudinal or acceptability perspectives limiting the consideration or provision of assistive technology devices. When teachers are not accepting of most assistive technology devices and services available for students with disabilities, it may lead to the lack of consideration of assistive technology which in turn prohibits the achievement of this IDEA stipulation. Clearly the teacher's limited knowledge of assistive technology and/or attitude regarding assistive technology are barriers to effective assistive technology use for students with disabilities as previously claimed.

Equipment as a Barrier

Assistive technology devices themselves may seem to be barriers to the consideration and provision of assistive technology services. Ongoing concern and evidence of efficacy of the device and the expansive array of services can be labeled as barriers. In this literature review equipment as a barrier will be categorized in the areas of efficacy and explosion. Efficacy will pertain to the lack of empirical evidence available pertaining to assistive technology and explosion will pertain to the sheer numbers of assistive technology devices that are available.

Efficacy. The efficacy of assistive technology is a barrier to effective use of assistive technology by a student with disabilities. Efficacy is a term used in product development practice. It has been commonly used as something having an effect of being useful, valuable, or working well. In the specific context of assistive technology devices, efficacy could be described as impacting or improving the functional capability of a student with disabilities (Stone, Lockett, Usiak, & Arthanat, 2010). The lack of research pertaining to measurement of assistive technology device outcomes or effects causes efficacy to be classified as a barrier.

Fuhrer et al. (2003) reviewed literature pertaining to the conviction that a conceptual model to measure and report the efficacy of assistive technology outcomes is considered necessary. "Huge strides in the growth of AT as an industry have not been paralleled by a corresponding development of research to access the outcomes of those technologies" (p. 1244).

The sparse number of outcome measures can be attributed to the lack of outcome research. The research that is available is generally narrow and focused on one assistive technology device or its user function. The function of assistive technology is perceived differently by different sectors' expectations. These sectors could include family members, manufacturers, service providers, payers, or other stakeholders. These groups have different outcomes they value including "users' enhanced physical functioning and well-being, reduced dependence on others, enlarged sense of control over their own lives, increased options for social participation and work, or reduced consumption of health and social services" (p. 1244).

Edyburn (2000b) conducted a review of research of assistive technology and students with mild disabilities. He noted that schools were willing to spend more of their funds to purchase assistive technology, but there was" little evidence on documenting the impact of these expenditures" (p. 19). Educators and policymakers continue to question the effect assistive technology has on learning and how this effectiveness could be measured.

Edyburn (2003) affirmed the disparity between the plethora of measures and indicators to profile the acquisition of assistive technology and the paucity of information to expose the impact or effectiveness of assistive technology. Recognizing this discrepancy in tools to measure effectiveness of assistive technology, Edyburn (2003) constructed a framework entitled "Understanding the Use of Evidence to Inform Decision-making about the Impact of Assistive Technology" (p. 13). In this framework, Edyburn (2003) categorized the development process of determining if assistive technology is effective into three distinct phases: exploratory phase, descriptive phase, and empirical phase.

In the exploratory phase there are two areas of evidence: intuition and observation. Intuition and observation evidence do not require any use of formal data collection. This data contains statements such as "I simply know it works." Since there is a lack of formal data collection in the exploratory stage, the evidence is rarely considered as credible proof that the assistive technology is effective (Edyburn, 2003).

Anecdotal evidence and case studies are evident in the descriptive phase of Edyburn's (2003) framework. Anecdotal and case studies used for determining the

effectiveness of assistive devices include both subjective and objective measures of performance (Jutai, Strong, & Russell-Minda, 2009). Anecdotal evidence is generally used to inform purchasing decisions by gathering stories and critical incidents to justify the effectiveness. Case studies typically utilize efficient procedures for data collection; however, they are usually focused on a single participant. Edyburn (2003) credits the descriptive phase as being the transition between sources of information from a personal basis to more scientific approaches in the empirical phase.

Group studies, research synthesis, and meta-analysis are the areas of evidence in the empirical phase. These three areas are considered the gold standard for arguments about verification concerning the effectiveness of specific interventions, as they seek to collect quantifiable data for statistical analysis (Edyburn, 2003). The uniqueness of the needs of each student with disabilities creates difficulties in attaining credible evidence in the empirical phase due to the small sample size.

Assistive technology devices and services make it easier for students with disabilities to participate in day-to-day activities. Assistive technology devices and assistive technology services have proven beneficial for individuals with disabilities in accessing school, home, and community activities. Assistive technology provides benefits to all students with disabilities including infants and toddlers accessing developmentally important activities. Today, the use of assistive technology by persons with disabilities is becoming a more common and accepted practice.

The sheer numbers of available assistive technology devices available complicates the process. What little research there is regarding efficacy is usually

specific to each device and not universal to a larger population of users. One of the drawbacks of special education research in general is the population sampled or studied is usually small in numbers. The unique needs of every individual and the requirement to individualize all programs and services provided to students with disabilities are also reflected in research pertaining to efficacy of assistive technology. The benefit one device can provide for one individual is generally not transferrable to another individual. Therefore, the efficacy measurements are more specific to individual assistive technology devices than assistive technology in general. This small number of operative measures of outcome of assistive technology devices has been identified as a barrier to effective assistive technology use for students with disabilities. This barrier impacts making financially responsible decisions and the ability for teachers to access information about specific devices to meet the unique needs of their students with disabilities. In conjunction with the limited amount of research on efficacy, the sheer number of assistive technology devices available can be classified as a barrier.

Explosion. Although the concept of assistive technology is fairly new, the development of the numerous devices can be overwhelming to all parties involved with assistive technology decisions. Equipment is "constantly evolving and new products find their way into the educational marketplace at a dizzying pace" (Parette & Peterson-Karlan, 2007).

In Edyburn's (2000b) review of assistive technology devices he noted the importance of the vast information pertaining to assistive technology devices and services but he also recognized that parents, educators, and assistive technology users have a

difficult time keeping abreast of developments, continual changes, and advances in this field. He notes, "The pace of change in the technology marketplace challenges scholars and practitioners to maintain their currency in the discipline of special education technology" (p.8). Huge strides in the vast numbers of assistive technology devices are evident in the literature. There are numerous devices listed of which consumers, teachers, and families are not even aware.

Edyburn (2001) referenced several woes expressed by a variety of voices to accent the dilemma of explosion.

> *If the most conscientious physician were to attempt to keep up with the literature by reading two articles per day, in one year this individual would be more than eight hundred years behind.* Octo Barnett, M.D. (Source: Swanson, 1998, p. 135, as cited in Edyburn, 2001, p. 5)

> *The summation of human experience is being expended at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-ridded ships.* Vannevar Bush. (Source: Bush, 1945, p. 102, as cited in Edyburn, 2001, p. 5)

These two quotes sum up the explosion factor of assistive technology. Teachers cannot possibly stay abreast of the amount of literature, the number of devices, the changing trends, or give consideration to reading and processing the amount of literature currently available. Teachers do not have the time or the knowledge necessary to process all of the components involved with assistive technology as it pertains to each individual student to make and implement instructional decisions.

Bausch and Hasselbring (2004) identified barriers which inhibit the delivery of assistive technology services. In concurrence with Edyburn, they noted one significant barrier was the extensive number of assistive technology devices that are available.

Bausch and Hasselbring (2004) justified the significance of the barrier with the following statements:

> Since the passage of the Tech Act, there has been a sizeable increase in the number of assistive and adaptive devices designed for use by persons with disabilities. ABLEDATA (2004), an online database of assistive technologies, lists more than 20,000 currently available devices. The Closing the Gap Resource Directory (2003), and online and printed guide for the selection of computer-related technology for special education and rehabilitation, lists nearly 2,000 adaptive computer technologies and specialized software programs developed by hundreds of different companies. The number of options seems staggering and assistive technology choices are not easy to make, especially considering persons with similar disabilities may benefit from very different technologies. Keeping up to date on the various AT devices available in order to make appropriate recommendations is a critical but time consuming responsibility for AT service providers. (p. 101)

Bausch and Hasselbring (2004) discussed this alarming rate of explosion of assistive technology devices. Their discussion supports the critical issue of the explosion of number of assistive technology devices that a provider must choose from as a barrier to successful implementation of assistive technology for persons with disabilities.

In an article referenced in an earlier section of this paper, Poel (2007) stated there are tens of thousands of commercially available assistive technology devices that individuals with disabilities can use. These high numbers of assistive technology devices available is a barrier to successful implementation of assistive technology for a student with a disability. One person or even one IEP team could not be knowledgeable about all the options of assistive technology devices available for use by a student with disabilities. Does this imply that teachers or IEP teams are not making informed decisions concerning assistive technology for students with a disability? It does support the claim that the

sheer number of assistive technology devices available is a barrier to successful implementation of assistive technology for students with disabilities.

One of the great challenges today is keeping up with the technology available for use. This ever evolving number of assistive technology devices available also makes it a challenge to keep current in the research about the effectiveness of a device. Research takes time to investigate and does not evolve as quickly as the assistive technology. Teachers need to have the knowledge of assistive technology devices and services in order to identify the supports they need to continue to meet the needs of their students with disabilities. The explosion of assistive technology devices and the paucity of research to support these devices reinforce the claim that equipment can be identified as a barrier to successful implementation of assistive technology for a student with disabilities. The final barrier identified in this study is the individual.

Abandonment of Assistive Technology Devices and Services

In this literature review individual as a barrier was categorized into the areas of abandonment due to lack of consideration of the user, matching, and abandonment due to lack of motivation. The user or individual was classified as a barrier if they chose to abandon the assistive technology device or service that has been selected. This abandonment could be caused by a mismatch of the individual and the device or service or as a lack of motivation to use or continue to use an assistive technology device or service.

Matching. In an article by Beigel (2000), the author painted a picture of a fourth grade girl, Anna, with above average intelligence who was struggling to read and respond

to books that her peers were enjoying. Anna's teacher recognized her potential and called for a team meeting. "The team met and examined a wide range of possible devices with the intent of maximizing Anna's potential" (p.237). The team chose a state-of-the-art small laptop computer to capitalize on Anna's potential. This technologically impressive assistive technology device did not meet Anna's needs and therefore was ineffective. The result was that Anna did not and could not utilize the device and abandonment happened almost immediately after Anna received the device.

This example exhibits the evidence of neglecting to keep the user of the assistive technology device at the center of the assessment process. Beigel (2000) pointed out that when the team "attended to Anna's individual needs, modifying the AT to meet those needs, Anna was much better able to use the AT effectively" (p. 238).

Beigel (2000) suggested finding a device that is useful to the learner in multiple environments as a caution regarding the assessment to prevent abandonment of assistive technology devices. "The purpose of AT assessment is to find ways to meet the needs of the learners by matching the strengths and weaknesses of the learner to the device" (p. 238)

In an article by Scherer and Craddock (2002), abandonment and the relationship of the importance of matching person and technology was referred to in the following statements:

> A good match of person and technology requires attention to aspects of the environments in which the technology will be used, the needs and preferences of the user, and the functions and features of the technology. If the match is not a quality one from the standpoint of the consumer, the technology may not be used, or will not be used optimally. There is a need for an improved person-AT matching and outcomes assessment process because studies and reports show in

> general that there is a high level of dissatisfaction and nonuse of technology by consumers. (p. 125)

Scherer and Craddock (2002) outlined the process of testing the reliability and validity of the Matching Person & Technology Model (MPT) using a variety of participants and settings. After proving the reliability and validity, Scherer and Craddock (2002) utilized the MPT to determine reasons for device nonuse or abandonment. The device was no longer needed was the response given the most frequently by users of assistive technology, however, the functional improvement measure (FIM) did not correspond with the user's perspective that the device was no longer needed.

In another test of consumer use and abandonment conducted by Scherer and Craddock (2002), the authors utilized the Assistive Technology Device Predisposition Assessment (ATD PA) form of the MPT. This assessment was given to 47 individuals with a variety of assistive technology devices being utilized. The assessment was given at the time of the recommendation to use a specific device and again at three months follow-up. A total of 128 devices were prescribed; of these, 42 were abandoned by the three month follow-up point. One possible explanation of the 34% abandonment was that "consumers have positive expectations of devices and, if actual performance falls short of expectations, the response may be to discard (abandon) use of the device; this may be prevented by longer trial periods with devices in a variety of situations" (p.129).

In an earlier paper written by Scherer (1999) and presented at the Annual Convention of the American Psychological Association, she outlined tips for rehabilitation psychologists to prevent abandonment of assistive technology. Scherer cautioned that assistive technology must be perceived to be worth the effort to set up and

operate, convenient and available when needed, and obtained for a reasonable cost. Scherer stated assistive technology "must have enough features to be useful and expandable, but not so many that the user becomes overwhelmed" (p. 10). She also commented that if a student has a disability that makes it necessary to use multiple devices, the likeliness of non-use would increase because of the complications involved. Scherer advised to select the most appropriate technology with all the right features and prevent abandonment the user's perception must be included in the decision.

Scherer, Sax, VanBiervliet, Cushman, and Scherer (2005) specified the user's perspective or factors in their article. They stated:

> Factors include their personality and personal attitudes; background experiences; lifestyle preferences; established interpersonal networks and communication needs; judgment and outlook regarding their perceived capabilities and functioning in a variety of situations; subjective quality of life/well-being; and the adjustment patterns they have established to deal with loss and change. (p. 1322).

A study was done by a group called Matching Persons to Technology and the results were compiled and shared by Ebner (2004), an occupational therapist. The rate of technology abandonment was as high as 75% to 80% in this study. Ebner (2004) summarized four possible reasons of abandonment: the device or service was not well matched to the person; little or no training provided to the assistive technology user or assistants; families did not accept the assistive technology device or service; and the school or workplace was not accepting of the assistive technology device or service. These reasons of technology abandonment were consistent with other studies reviewed.

According to Day, Jutai, Woolrich, and Strong (2005; as cited in Scherer et al., 2005), "In spite of the increased variety and availability of AT, approximately 30% of

obtained ATs are discarded within a year" (p. 1323). The authors imply the major reason for this high rate of abandonment is related to a poor assessment of consumers' needs and preferences. They also stated that many professionals working with persons with disabilities are unaware of how to obtain or fund assistive technology.

"Assistive technology devices enable individuals with disabilities to participate in society as contributing members" (Riemer-Reiss & Wacker, 2000, p. 44). These authors conducted a study to determine the factors associated with assistive technology continuance or discontinuance. This study was conducted in Colorado with the use of a survey. Part of the survey was conducted over the telephone with the other part mailed to recipients.

The sample size was 115 individuals with disabilities. The range of ages of participants was under 20 to over 70 years. Although this study was not specifically designed for students, 28.7% of the 115 participants were under the age of 18. The assistive technology devices used in this study ranged from low tech to high-tech. Riemer-Reiss and Wacker (2000) gave examples of high-tech devices as personal computers and low tech devices as canes or reachers. The authors reported 32.4% of the individuals sampled discontinued the use of their assistive technology device. Another finding in this study was "consumers must be involved in the selection of their assistive technology. Abandonment would be decreased if a collaborative, consumer-oriented model were utilized in all technology service delivery environments" (Riemer-Reiss & Wacker, 2000, p. 49).

Phillips and Zhao (1993) conducted a study pertaining to assistive technology abandonment. The participants in this study were adult users of assistive technology however; many of the issues relevant to abandonment are consistent with all age groups.

The study utilized the survey method. The target population was a nationwide sample of adult users of assistive technology with a variety of identified disabilities. The telephone survey was administered to 227 people representing 28 states. In this study, "abandonment was defined as nonuse of a device type or category at the time of the survey" (p. 38).

After a statistical analysis of the data was completed, the following four distinct factor variables emerged. The variables and the questions they were trying to answer were: (1) performance, did the device help you; (2) energy demand, the effort required to use the device; (3) convenience, was the device easy to store and transport; and (4) assistance, help needed from others (Phillips & Zhao, 1993). The participants reported using 1732 different devices and 29.3% of these had been abandoned. After further analysis the "data suggested that most abandonment occurs after five years or within the first year of use" (p. 40).

Phillips and Zhao (1993) analyzed and organized the data into four distinct factors: performance, energy demand, convenience, and assistance, and found only performance was significantly related to abandonment. "If the device met the user's expectations for effectiveness, reliability, durability, comfort, safety, and ease of use, the user was more likely to keep the device" (p. 41). However, individuals with disabilities

are frequently dissatisfied with their assistive technology and as a result, discontinue its use, driving the rate of assistive technology abandonment alarmingly high.

Other implications from this study reiterated barriers identified in the current study including training, screening, marketing, and knowledge. Phillips and Zhao (1993) noted "Technology abandonment can have serious repercussions. For individuals, non-use of a device may lead to decreases in functional abilities, freedom, and independence and increases in monetary expenses" (p. 36). Seeking a student's input whenever possible and selecting assistive technology devices that peers perceive as "cool" (Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005) can help to lower abandonment rates. Students want to blend in and be part of the group. The data in these studies identify discomfort, energy or effort to use the device, prior level of skills, and poor quality of devices as a few of the causes of abandonment of assistive technology devices or services. Abandonment can be identified as a barrier to effective assistive technology use for students with disabilities due to the fact if the device or service is not being utilized there is no opportunity for a benefit. If the assistive technology device or service is successfully matched with a student with a disability it takes ongoing support to motivate the individual to utilize the device.

Motivation. Elder-Hinshaw, Manset-Williamson, Nelson, and Dunn (2000) outlined a reading project to engage and motivate older students with reading disabilities. The authors realized how difficult it was to engage students in reading especially when the students are older and have struggled throughout their years in school. The authors looked for a motivating inquiry activity where students would have to apply reading

comprehension strategies but would contain the accessibility and flexibility that technology could provide.

The authors developed a project in which the students could make a choice on what to present about but had to use the PowerPoint format to present. The use of the computer allowed students to access speech-to-text and text-to-speech assistive technology. The freedom in choices the students were given and the scaffolding of the reading skill provided by assistive technology supplied the motivation factor students required to complete a successful project (Elder-Hinshaw et al., 2000). The authors summarized their students' success with this comment: "The authenticity of the task and novelty of the multimedia provides an opportunity for students, including those with reading disabilities, to practice comprehension strategies within a motivating activity" (p. 7).

Parette and Scherer (2004) explored literature in regards to the stigma associated with assistive technology use. The authors suggested stigma is a cause of assistive technology abandonment. One of the specific areas they addressed was a teacher's acceptance level of a disability and the use of an assistive technology device to compensate for this disability.

"Teacher acceptance becomes particularly important given the importance of examining the milieus and the challenges/supports available in each setting AT will be used" (Parette & Scherer, 2004, p. 221). If the teacher, as the leader in the classroom, does not accept a student with disabilities or the necessary assistive technology device utilized by the student, into their classroom, the students will generally follow the

acceptance level of their leader and not accept this student either. When assistive technology abandonment does occur it is a barrier to a student with disabilities.

The acceptance level of the leader and the peers can play an important role in the motivation of a student's choice to continue the use of or abandon the assistive technology device. This supports the claim that the individual themselves can be a barrier to the effective implementation of assistive technology for students with disabilities.

Abandonment whether termed discontinuance, non-use, rejection, or desertion is a barrier to successful implementation of assistive technology for a student with disabilities. If a person chooses not to use the assistive technology device due to not being included in the decisions regarding the device, by the negative perception, or is not motivated to use the device, the assistive technology device will not help this student to access the general education curriculum.

Analysis

Assistive technology devices can be very beneficial in the general education and special education classrooms. However, there are several things teachers need to be aware of and understand when it comes to using assistive technology in these classrooms. This section of the literature explored how teachers need to be aware of the barriers that exist and know how to overcome them, the laws that have been implemented and how they affect assistive technology and the classroom, and the benefits of assistive technology and how to choose devices accordingly.

There are several barriers identified with assistive technology devices. Monetary barriers, including the costs of purchasing and maintaining the devices, are some of the top barriers identified. The teacher's lack of knowledge pertaining to the devices, as well as an unaccepting attitude, is also barriers identified for assistive technology devices. The sheer amount of devices and the fact that research cannot keep up with the development of devices also hinders the use of assistive technology devices. Teachers need to be aware of all these barriers and work to overcome them in order to avoid abandonment of the devices.

Although several barriers to assistive technology still exist, many laws have been implemented to enhance the use of assistive technology. The Tech Acts, ADA, and IDEA legislative initiatives have provided numerous programs and services to help people with disabilities have equal access and use of assistive technology devices and services. Teachers need to know the laws and possess the skills to implement these laws and assistive technologies to effectively provide access to the general education curriculum and meet the challenge of providing the best education possible for all students with disabilities. In order to meet the legal obligations of these statutes, teachers must have a clear understanding of assistive technology devices and services and a methodology for identifying the assistive technology needs of students with disabilities.

Along with being aware of the barriers and the laws pertaining to assistive technology, teachers also need to be aware of the numerous benefits associated with assistive technology. The use of assistive technology can foster success and independence for a student with disabilities, as well as create more opportunities to

socialize and raise self-esteem. This literature review would lead us to question if the teacher has the resources to recognize the benefits and overcome the barriers of assistive technology to provide the greatest opportunities for students with disabilities..

The benefits of assistive technology can make a difference in the lives of students with disabilities. Teachers need to be aware of the barriers to assistive technology and how they can avoid them, know the laws pertaining to the devices and how they affect the classroom, and be able to recognize the benefits and use that knowledge to choose devices appropriately for each student. This is a very large task for teachers, and if they are not prepared for the task, the use and success of assistive technology for students with disabilities will be greatly reduced.

Teachers need to be aware of the barriers that can hinder successful assistive technology use by students with disabilities. Teachers need to be cognizant of the high costs of purchasing assistive technology and the maintenance costs required as they relate to choosing the most appropriate assistive technology and devices. Teachers need know and understand all the components of assistive technology from the consideration step clear through the implementation and trials, to the ongoing monitoring to ensure the assistive technology device or service is still appropriate. Teachers will have to be aware of their own attitudes and attitudes of other people involved. Teachers will have to know how to monitor and adjust all these barriers in order to prevent abandonment. What resources and challenges are teachers faced with as they move through this process? How can teachers be supported to meet all the demands of providing assistive technology to students with disabilities when there are numerous barriers to overcome?

Assistive technology has been formed through legislative acts in an effort to provide benefits and eliminate barriers to access for students with disabilities. Assistive technology devices and services are one service included in a free appropriate public education (FAPE) in the least restrictive environment, which every student with a disability is entitled to.

Teachers need to know the laws and their requirements and what assistive technology is to consider, evaluate, and provide appropriate recommendations of assistive technology devices and services to students with disabilities. Teachers must have this legal background and awareness of assistive technology to enhance benefits and alleviate barriers children may encounter.

CHAPTER 3

RESEARCH METHODOLOGY AND METHODS

Research Methodology

The purpose of this study was to discover the processes and factors that teachers of students with disabilities use in considering adopting and utilizing assistive technology to meet the needs of students. The study explored, from the standpoint of the teachers, the advantages and challenges encountered in adopting and implementing assistive technology to meet the needs of their students with disabilities. A qualitative research approach was used to explore these questions.

Qualitative research can be used to describe and analyze people's individual and collective social actions, beliefs, thoughts, and perceptions. Several assumptions guiding this qualitative research may be detailed. Reality is socially constructed and is different for every person. "Qualitative research approaches portray a world in which reality is socially constructed, complex, and ever changing" (Glesne, 2006, p. 6). Reality is the combination of all experiences, beliefs, attitudes, and phenomena (Glesne, 2006). Reality is shaped by past and present individual experiences which are why reality is complex and ever changing. People may be influenced by their training, friends, family, and successes and failures. Researchers must understand and contextualize the multiple perspectives of the participants. Individuals' experiences are interwoven, which makes it difficult to measure or quantify these experiences (Glesne, 2006).

Creswell (2003) described qualitative research as taking place in the natural setting using multiple methods that are interactive and humanistic. "Qualitative research

is emergent rather than tightly prefigured" (p. 181), and as the inquirer explores information the research questions may change due to the new knowledge. Brantlinger, Jimenez, Klinger, Pugach, and Richardson (2005) defined qualitative research as "a systematic approach to understanding qualities, or the essential nature, of a phenomenon within a particular context" (p. 195). Qualitative researchers seek explanations, understanding, and clarification of similar situations (Hoepfl, 1997). A researcher must establish a rapport with the participant and develop a relationship in order for the participant to trust and share their experiences.

Qualitative research methods were used to "understand some social phenomena from the perspectives of those involved, to contextualize issues in their particular socio-cultural-political milieu, and sometimes to transform or change social conditions" (Glesne, 2006, p. 4). Researchers focus on an emerging process as they attempt to observe and describe the process in the natural setting (Hoepfl, 1997). Qualitative research methodology included conversations, dialogue, and interactions. It allowed the participants to share their story from their personal perspective. Thus, knowledge and meaning will be constructed through social interaction and understanding (Ferguson & Ferguson, 2000). Qualitative research seeks to understand the participants and listen to their interpretation to gain a rich understanding of the process that teachers of students with disabilities undertake in considering, adopting, and utilizing assistive technology for students with disabilities.

Research Methods

This study was a qualitative case study that examined the process teachers employ to consider adopting and utilizing assistive technology for students with disabilities. A case study allows a researcher to "explore in depth a program, an event, an activity, a process, for one or more individuals" (Creswell, 2003, p. 15). For this research, the case was defined as the assistive technology process. The assistive technology process was the case studied through the experiences of three elementary special education teachers.

The case study has been used to contribute to the knowledge pertaining to individual, group, social, and related phenomena (Yin, 2003). Stake (2000) identified three types of case studies: intrinsic, instrumental and collective. The intrinsic case study has been utilized when the researcher has a personal interest in a topic and wants a better understanding of that particular topic. The instrumental case study focuses on one topic with the intent of understanding that topic to have a bigger impact within the field. Stake (2000) defined a collective case study as one in which a researcher studies a "number of cases in order to investigate a phenomenon, population, or general condition" (p. 437). For this study, the researcher used the instrumental case study to examine the assistive technology process (the case) in order to examine the potential impact for the field of special education.

Participants and Classroom Settings

The site chosen for this study was a small rural school in the Midwest. The school was a preschool through grade 12 facility with all classrooms located under one roof. This site was chosen because it was convenient and it permitted frequent classroom

visits and a variety of subsequent interviews. The site was within a reasonable distance from the researcher's place of employment, which allowed for more frequent interaction with the participants.

In this rural school district, the superintendent's consent was the only step required to conduct a research study within the district. The researcher obtained consent from the superintendent in an email and completed the Human Participants Review process before an email containing a scripted message (See Appendix G) was sent to each of the participants. The participants all agreed to take part in the study through a return email. Prior to the first interview, the researcher shared the University of Northern Iowa Human Participants Review Informed Consent form with each participant to ensure the rights and welfare of each participant were protected by carefully explaining the purpose and intent of the study. Each participant confirmed their willingness to participate in the study and signed the form. Participants were informed they had the right to refuse or withdraw participation in the interview or the study at any time.

Four teachers were employed by this small rural school district to deliver services to students with disabilities at the elementary level. This study focused on three of the four teachers Lisa, Mary, and Sara. The number of participants was satisfactory with three of the four possible elementary teachers selected for the study. Their classrooms were all located in the same hallway as the elementary office, small group reading classrooms, and library. Even though they were not in the same hallway as the general education classrooms, they were in the main traffic flow of the elementary wing.

Two of the three teachers provided services to students in a classroom intended for special education services and in a classroom intended for general education services. The third teacher provided services to students with significant disabilities with most of these services being delivered in the classroom intended for special education services. The three teachers provided an example of the continuum of least restrictive environments provided by most school districts in the Midwest. The participants were representative of the population of elementary special education teachers in this district.

Lisa. Lisa was a first year teacher; she had only been in the classroom five months at the time of the first interview. Lisa graduated with her elementary teaching degree and an endorsement in special education. She was teaching students with mild disabilities in fourth through sixth grade. Since Lisa was so new in the teaching field, she reflected mainly on her preservice training and student teaching experiences.

Lisa was very quiet and reserved during the interview. She had short answers to questions and seemed hesitant to answer most of the questions. Lisa hesitantly reported she felt like she was possibly a resource for teachers on the iPad as she had taken the time to explore with it. She shared that she was a hands-on learner and liked to work with materials or equipment rather than read about them. Lisa admitted that she had very limited knowledge pertaining to assistive technology, but she liked using the iPad. Lisa expressed she could help other teachers with the iPad but not any other assistive technology devices.

Lisa shared her room with a teacher who managed the after school program, so there were many supplies housed in the classroom. Lisa had the section of the classroom

closest to the door, but there was not a divider in the center of the room. Three desktop computers on small tables were close to the front door next to the whiteboard. A rectangular-shaped table was situated in front of the whiteboard with six chairs at the table. An Elmo sat on a tall rolling cart and another tall rolling cart held a liquid-crystal display (LCD) projector. There was a small round table with four chairs towards the window side of the whiteboard. Beside this small round table was Lisa's desk. Lisa's room also had the same wall of cupboards as Mary's and Sara's rooms. Lisa's room was cluttered around the edges, but the students' work spaces were free of distractions. Pencil grips, raised line paper, and wiggle cushions were examples of assistive technology found in Lisa's classroom.

Mary. Mary had an elementary teaching license with endorsements in preschool through grade three early childhood, reading, and coaching, as well as an endorsement to teach students with mild disabilities. At the time of this interview, Mary had taught for eight years in a special education classroom for students with mild disabilities. Mary originally worked for the Head Start system and covered 17 centers in Northeast Iowa. She talked about traveling to professional development opportunities all over the United States and then teaching classes to Head Start teachers in her centers.

Mary was very enthusiastic and enjoyed sharing information. Mary described being in the school system as, "I love it. It is awesome!" Mary was exuberant and loved to share information about her classroom and teaching ideas. She shared how she was a resource for all the general education teachers. Mary usually had a big smile and a warm

greeting and was a welcoming individual. She seemed confident and shared she enjoys teaching. Mary was happy and energized.

Mary's room was full of materials. Her desk was along the wall of windows with three desktop computers in the front corner to the left of the whiteboard. A short bookcase was perpendicular to the wall and contained teacher's manuals, student books, and a variety of supplies. On the top of the bookcase was an organizer to hold file folders for each day of the week. There were low bookshelves under the whiteboard that were full of a variety of materials, books, and supplies. A large kidney shaped table was centered in front of the whiteboard. The students' chairs faced the whiteboard with the teacher's chair facing the center of the room. In the center of the room there were two large cupboards put side by side to provide a barrier between the two classes housed in one room. An Elmo on a tall rolling cart was to the side of the cupboards. The door to the classroom was along the same wall as the whiteboard. There was a small desk without a chair positioned right inside the door below a bulletin board. The door was solid wood with a side glass window. The room was inviting and the furniture was all appropriately sized for first grade students. Pencil grips and visual cue cards were examples of assistive technology found in Mary's classroom.

Sara. Sara had been a teacher for 22 years and had spent the past 12 years as the teacher in a classroom for students with significant disabilities. Sara had a secondary education degree in both English and German. She had special education endorsements in multi-categorical and severe and profound, which were the licensure categories used when she received her endorsements. Sara reported that she was two classes away from

completing her Master's degree with an endorsement to teach students with significant disabilities.

Sara was open and relaxed from the beginning of the conversations. She was eager to share information and asked questions about assistive technology. Sara was very upbeat and positive throughout the interview. She was quick to jump up and grab the assistive technology device she was discussing. Sara seemed to enjoy the challenges of teaching and meeting the needs of her students with significant cognitive disabilities.

Sara's room had five large pieces of adaptive equipment housed in the corner, including two specialized wooden chairs, an adapted bike, a wheelchair, and a prone stander. Sara had a sensory swing suspended from the ceiling in her classroom. Her room contained many materials, but the students' quiet work areas were uncluttered with a small desk, a chair, a shelf, and work baskets. There were two rectangular tables that seated six students and one round table that seated five or six students. The tables were all about mid-thigh height, which was appropriate for the students in this classroom. Sara's room also had a refrigerator, stove, and a microwave. Sara also said she would like to have a washer and dryer. There was a whiteboard on the opposite side of the room as the partitioned off areas. Sara did not share her room with another class. Her room contained the most materials; however, it seemed the least cluttered. The three classrooms looked similar but all had unique characteristics personal to each participant.

Data Collection

The data collection involved the use of multiple methods to address the issue of representation and to ensure trustworthiness. These methods included use of multiple

face-to-face, in-depth individual interviews with each of the teachers. Extensive quotes, visual representation, and explicit descriptions of how the data were coded and categorized were used. All of these steps were taken to ensure that the researcher's own biases did not influence the data from the participants. Initial data collection took place over a period of five months. The interview approach was used in an attempt "to understand the complex behavior of members of society without imposing any a priori categorization that may limit the field of inquiry" (Fontana & Frey, 2000, p. 366). This approach provided flexibility for the researcher to pursue a variety of topics the teachers wished to discuss, related to variations on the main questions. An open ended style of questioning was used to elicit more information and dialogue from the participant. The first interview questions were typed out so the researcher was using similar wording between participants when asking questions. This interview format allowed for analysis of previous responses and preparation of questions for future interviews. Self-reflections and interpretations added into the transcribed interview responses, along with a journal, served as an audit trail.

Confidentiality was maintained throughout the study by recording the interviews on a small digital recorder placed in clear view of the participants. Interviews were then transcribed by the researcher into a word document on a personal computer to which only the researcher had access. All files and transcriptions were treated with respect and sensitivity. Any information which could have identified a particular individual was removed from any reported data. The participants were assigned pseudonyms.

Classroom visits. In addition to in-depth interviews, the researcher visited each classroom to observe the environment of the classroom, to take a tour of the classroom, and to inventory and observe available assistive technology. With permission through the standard application for human participants review and the consent of the participant, photographs were taken and diagrams or sketches were created of the classroom to create density of data (Glesne, 2006). These diagrams helped when recalling information and led to deeper understanding of the teachers' narratives. The observational visits were just to get a better understanding of the contexts in which these teachers were talking. The pictures from Mary's and Lisa's rooms revealed low tech assistive technology, whereas Sara's room had more high-tech assistive technology. The pictures taken in Sara's room contained large adapted furniture, bikes, swings, and various standing and sitting equipment. Photographs were not taken of any students of the classrooms visited. The major data source for this study was in-depth interviews, but the classroom visits added depth to the context of the conversations shared by each participant.

Journal. A journal for reflection was utilized throughout the study to record body language, facial expressions, and interesting thoughts that occurred before, during, and after the interviews. According to Janesick (1999), a journal may serve the purpose of refining the "understanding of the role of the researcher through reflection and writing, much like an artist might do" (p. 506). This journal contained personal comments, small drawings, and notes which aided in the ongoing data collection and reflection. This journal provided details about each of the participants and their classrooms as shared in this study.

First Interview. The first interview of each teacher consisted of getting acquainted and gathering background information which provided a better perspective of the teachers' beliefs and values regarding the education of students with disabilities and their families. A series of open-ended questions guided the initial interview with each of the participants (See Appendix A). First round interview questions were developed by the researcher and approved by two qualitative researchers. Each of the interviews was conducted in the teachers' individual classrooms after school, which was each teacher's choice, and at a time when students were not present. During the initial interview, the researcher developed a rapport with the participants and carried on a conversation to gather personal information and teaching experience. This initial information was obtained to assist the researcher in gaining a better understanding of each teacher and was used to enrich the study. As the researcher transcribed this information taken from the initial interview, notes were added in the journal and within the transcription, which led to second round interview questions. For example, when Mary was asked to describe a barrier of assistive technology she replied, "The awareness of it.... what is out there". This comment then became a category of a barrier and a subcategory of awareness of assistive technology. Appendix B shows an example of this initial coding.

Second interview. During the second interview, the researcher began to explore more deeply the teachers' experiences with assistive technology. Mary was asked to expand more on the category of a barrier through questions about her training at preservice and inservice levels (See Appendix C). Second interview questions were developed from a review of transcripts, coding, journal notes, and research questions.

Specific questions targeted at what teachers felt their role was in the assistive technology process, what the resources and challenges were pertaining to assistive technology, and in what professional development they had participated were asked. The following themes adopted from the theoretical frameworks were explored during the second interview: the teachers' perception of their legal obligations, elements that influence the diffusion of assistive technology, characteristics of the assistive technology decision process, the influence of communication channels and the teacher's social system, and the perceived ease of use or perceived usefulness.

In addition, clarifications of answers, extension of answers, and follow-up questions from the first interview were also conducted. Sara's second interview was conducted in her home as she was on a leave of absence due to an injury.

Third interview. Prior to the third interview, the researcher revisited the research questions and the questions and answers from the first and second interviews. Areas specific to each participant were identified that needed further exploration, which led to the development of the third round interview questions. These questions were then reviewed and further refined with two experienced qualitative researchers at the University of Northern Iowa. The questions and discussions during the third interview allowed the teachers to affirm or clarify ideas gleaned over the course of all the interviews and expand on areas or topics that were still unclear to the researcher. For example, Mary had shared in an early interview that one of her students used a name stamp to sign his name. In the third interview questions were asked to clarify the process through which this assistive technology piece was chosen (See Appendix C). The

researcher also identified any new codes that were suitable as well as utilized previously developed codes during the coding process. For example, Mary repeated on multiple occasions that she did not have enough information about assistive technology. This was coded by the researcher as Lack of Teacher Knowledge. This was labeled Awareness under the theme of Limited Awareness of Assistive Technology as a Significant Barrier (See Appendix D).

Data Analysis

The process of data analysis involved making sense out of notes, images, reflections, and any other data collected during the study (Creswell, 2003). Data analysis and interpretation occurred concurrently with the collection of the data so that the researcher could return to the participants with supplementary questions seeking additional in-depth descriptions and responses through follow-up interviews. "Data analysis is not a structured, static, or rigid process. Rather, it is free-flowing and creative..." (Strauss & Corbin, 1998, p. 58).

Coding of interview data. Glesne (2006) considers coding a "progressive process of sorting and defining and defining and sorting those scraps of collected data" (p. 152). Referring back to the photographs, drawings, inventory, and journal enabled the researcher to examine the participants' responses by adding "visual clarity to the organization and reflection of data" (p. 152). The data from this study were organized and prepared for analysis by transcribing the interview conversations into text documents, reading and rereading the transcripts, adding margin notes, sorting and arranging the data into categories, and labeling those categories with terms. This information was then used

to generate themes. Concepts or themes were identified from the data that reflected the meaning of data. For example, all three of the participants shared examples of not having enough time to explore or learn assistive technology which was originally coded as time and eventually became a subcategory within the theme of barrier of assistive technology. Codes were created, restated, thrown out, and sometimes brought back in as the collection of data was progressive throughout this study and involved continuous rephrasing of the categories to ensure appropriate coding. This was a systematic development of categories and relating categories and subcategories.

Using open coding and a constant comparative process, the researcher constructed categories based on analyzing sentences and paragraphs of responses from the participants. Strauss and Corbin (1998) used this analogy: "Open coding is like working on a puzzle. The analyst has to get organized, sort the pieces by color,... and build a picture by putting the individual pieces back together" (p. 223). Within the categories, subcategories emerged and were identified. Simultaneously, the researcher used axial coding to relate categories to their subcategories. This allowed the researcher to cultivate an understanding of the linkages between phenomena or issues mentioned by the participants as they told their stories of the process of consideration of adopting and utilizing assistive technology to meet the needs of their students with disabilities. In this study, using both axial and open coding allowed for understanding, categorizing, and clarifying the data. An example of this data is shown in Appendix E. Categories were saturated during the coding when no new or relevant data emerged regarding the category (Strauss & Corbin, 1998).

The researcher used open coding to identify many different categories and subcategories that emerged. Within the open coding format, the researcher utilized Strauss and Corbin's (1998) three-tier data analysis process for qualitative research. The first tier of analysis created an initial coding which consisted of reading and rereading the transcripts and highlighting words that were mentioned frequently or by more than one participant. Along with highlighting, notes, ideas, or preliminary themes were listed in the margin of the transcripts (See Appendix B). No specific list or definite set of codes were formed and used. The codes were often phrases or sentences explaining the concepts.

In second-tier coding, these initial highlighted words and margin notes were then organized into categories. The transcripts were read repeatedly to identify core categories and subcategories. By conducting an in-depth, detailed comparative analysis of the data from each participant's interview, concepts that shared common characteristics were similarly grouped into common categories and subcategories. Forming categories is important because "it enables the analyst to reduce the number of units with which he or she is working" (Strauss & Corbin, 1998, p. 113). Categories are higher order concepts derived from data which "have the potential to explain and predict" (p. 113). Categories answered the question, "What is going on here?" (p. 114). For example, when asked about barriers to assistive technology, each of the participants responded with similar answers that indicated time might be a barrier.

Axial coding was also utilized, allowing the researcher to relate categories to their subcategories (Strauss & Corbin, 1998). Strauss and Corbin (1998) explained axial

coding as the process of putting the puzzle pieces back together. Relating the identified categories and the data collected by asking who, what, when, and where questions occurred during axial coding. New categories developed during this process. The researcher took the transcribed notes and physically cut them apart and organized them under categories, shuffling notes from one category to the next in an attempt to create categories with similar data (See Appendix D). From these categories themes were developed. For example, the researcher originally organized Lisa's comments, "Fluency was increasing," and "For me I have seen it more on the focus..." in the category of benefits and then under a new subcategory of academic benefits. Using both axial and open coding allowed for understanding, categorizing, and clarifying the data.

Finally, the journal was used as a tool to reflect and collect data. Writing self-reflections or observations in the journal allowed for a greater depth or richness of the data collected. The journal was used during the interviews to record facial expressions, tone of voice, mood of the participant, distractions in the setting, other nonverbal characteristics, and pondering of the researcher. The journal was not coded, but information was gathered from recorded data in the journal to enhance data collected during the interviews. Questions in the journal helped to probe deeper into the message from the participants. "Journal writing allows one to reflect, to dig deeper if you will, into the heart of the words, beliefs, and behaviors we describe in our journals" (Janesick, 1999, p. 513). The journal allowed the researcher to continuously go back and reexamine information and question the meanings associated with the data.

Research reliability. Several quality indicators as described by Brantlinger et al. (2005) were established throughout the process. Brantlinger et al. (2005) identified quality indicators for interview studies as selecting appropriate participants and representing them fairly, constructing reasonable interview questions, utilizing adequate mechanisms to record and transcribe interview, and ensuring confidentiality. In order to meet these quality indicators, participants were purposefully selected, effectively recruited by inviting this specific group of teachers to participate in this study. The interview questions were reviewed by two qualitative researchers to ensure they were clearly worded and not leading, and responses were digitally recorded and transcribed by the researcher to ensure confidentiality.

Member checks were conducted with each of the participants following the transcription of their final interview. Member checks ensure and confirm accuracy of the qualitative findings (Brantlinger et al., 2005; Creswell, 2003). All three participants chose to have the member checks conducted through email. Comments received from the member checks included, "It looks good," from Lisa. "Thanks for doing this and I hope it really helps us teachers get more information on AT," from Mary. Sara responded, "Mine looks good and I am anxious to talk to you about your results."

CHAPTER 4

FINDINGS

The purpose of this study was to discover the processes and factors teachers of students with disabilities use in adopting and utilizing assistive technology to meet the needs of their students. Interviews were conducted in an attempt to capture the story of the resources and challenges that teachers encounter as they consider, adopt, and utilize assistive technology to meet the needs of their students with disabilities. The research questions were (a) How do teachers of students with disabilities characterize the process of obtaining assistive technology devices or services to meet the needs of their students with disabilities?, (b) What factors influence the process of adopting and utilizing assistive technology to meet the needs of their students?, and (c) What resources and challenges do teachers of students with disabilities encounter in adopting and utilizing assistive technology to meet the needs of their students?

Based on the data analysis and literature reviewed, five themes emerged. These themes were Diversity in Shared Assistive Technology Experiences, IEP Team Guides the Assistive Technology Process, Reliance and Resources in the Assistive Technology Process, Academic and Student Independent Benefits, and Limited Awareness of Assistive Technology as a Significant Barrier.

Diversity in Shared Assistive Technology Experiences

All three of the participants shared unique experiences pertaining to assistive technology. The participants varied in age, years of teaching general education and

special education, and preservice and inservice training. All of these variables impacted their experiences with assistive technology devices or services.

The diversity in the experiences led to the participants being categorized as Visitor, Traveler, and Explorer. These categories related to people on a trip and how they navigated their way through a vacation or voyage. Lisa was the visitor, Mary the traveler, and Sara the explorer.

Visitor

Lisa was a first year teacher having completed her undergraduate degree with a special education endorsement. Lisa, the visitor, was moving timidly through the school year accepting advice from the experienced traveler and the innovative explorer. A visitor is anyone who is not local or who is in a location to tour or to see the sites. They are careful to not offend any of the natives and stay on the beaten path, unless asked to step off, carefully choosing the safe route. Lisa started out on the safe path. "Since I have been new," she said, "I just say OK and yah that sounds good." She wanted to learn from the experience of other teachers. "I ask the teachers and they say, 'No, do what you want to do,' but I say they know the kids better." Lisa described assistive technology as "resources that can help your child better their education not necessarily electronic technology paper, pencil grips, seats that bounce or don't bounce or just stuff that will help your child be more focused or more successful at school." Lisa's stories and responses identified her as a visitor.

Traveler

Mary, the traveler, was traversing along the way and taking in ideas that were in her view or that were just out of her view. She was content to go along her designated path and fill in with a few things that popped into her line of vision. The traveler approaches the journey with an open heart and trusts the information she receives from the explorer or others. Mary, a young mother and wife, reported arriving at school by 7:45 each morning and sometimes staying until 7:00 in the evening to try to accomplish everything. She shared the demands of her family, teaching and individualizing instruction for students and supporting general education teachers as priorities for her, which did not leave her time to go out and find things independently.

The traveler is not looking for the discovery but is instead looking to see the already discovered with her own eyes. "I think just having people telling you that these things are out there is helpful," was one of Mary's responses. Mary relied on others to share what they have discovered. "I am waiting for my psych to look through them," Mary responded when asked about discovering new apps for the iPad. Travelers engage with the discovery and explore a few new landscapes but mainly stay on the beaten path. For example, Mary said, "At an initial IEP [meeting] I have had some insight for the psych that maybe they [the student with disabilities] need something." Mary also commented, "Oh, this is what we have done in the past, so we are just going to click that box, and here it is." Mary described assistive technology. "I would tell them [the parents] that it is any type of device or hands on materials that would help their child be successful in their education environment." A traveler might get the basics down and see

the sights, maybe take a few pictures, and then go home and be happy with the experience upon which they have scratched the surface. Mary's stories and responses identified her as a traveler.

Explorer

Sara, the explorer, was always looking for innovative ideas and studying creative prospects. An explorer is a person who finds things and travels in many different directions to discover what they want to know. They are blessed or cursed with this drive to discover. Sara commented, "You can't claim that you do not know about it. You have to go out and find it." Sara described assistive technology as "any type of device, and it could be electronic or simply like a product or paper that is going to help a student ....it helps a student complete something they are not able to complete ....in general ed or spec ed."

In addition, Sara, as an explorer, shared other resources she takes advantage of to learn about assistive technology. These resources included medical providers, personal experiences, and self-motivation. Sara gets off the beaten path, travels in many different directions, and digs deeper into innovative ideas to ensure she is providing all she can for her students.

Sara stated she gathers ideas from parts of her personal life. "In the summertime I judge 4-H projects for kids, and I learn a lot from their projects. We stamped with bubble paper to practice names." Sara reported she has had to be self-motivated to keep abreast of assistive technology during her years of teaching. Sara explored assistive technology so she did not have to rely on other IEP members to take time to teach her. Sara felt like

it was her job to go out and learn about assistive technology and to not sit back and expect her occupational therapist to take the time to explain devices that students needed to utilize.

Sara explained her need to be an explorer of assistive technology was due to not growing up with technology but having to learn it as an adult. Sara categorized herself as "a digital immigrant" since she did not grow up with technology. She explained that some of her desire to explore assistive technology was due to the fact that she hated "jumping in without having it all planned and knowing what is going to happen or could happen."

An explorer gets off the beaten path and digs deeper while using the resources they have available. She found out she would be getting an iPad, so she "did a little research" about a specific app and she "talked and called some people." Sara's stories and responses identified her as an explorer. Lisa, Mary, and Sara's classifications as the traveler, visitor, and explorer, respectively, were also evident within the data regarding the IEP teams' involvement with the assistive technology process.

IEP Team Guides the Assistive Technology Process

Lisa, Mary, and Sara reported different levels of involvement from the parents as part of the IEP team. Sara credited the IEP team with playing a large role in the consideration of adopting and utilizing assistive technology to meet the needs of her students with disabilities.

Parents

Parents are members of the IEP team, but they also are independently exploring ideas on their own to benefit their child with a disability. Sara reported the parents are a key factor in the assistive technology process.

> I give a letter to the parents before the meeting that says these are the goals we have been working on this year, and is there anything else at home that we could be working on. The parents have time to think about it and bring it to the meeting. Anything that the parent is looking at to use at home, like independent skills, or living skills, and then we talk about how to meet those needs at the meeting.

Sara shared how she has to take a parent's input into careful consideration. Sara listens to the parents' requests and then she, acting on behalf of the school, can take the initiative to evaluate that particular assistive technology device for the student and parent.

> You have to understand that you are the teacher and you deal with them from 8-4, but they have them the other 16 hours a day and they are going to have them from [age] 18-21 and on. I look at anything they are suggesting, and I tell them let me see.... When the iPad came out and they [parents] right away said we are going to get one, and I said, no, just let us test them out here at school first before you spend the money.

Sara reported her parents are more aware of services and assistive technology that could possibly benefit their child with a disability.

> I will say this, the last three years the parents are much more advocates. Some of this is the money part because they are becoming more aware of the money and they are getting funding. Sometimes the parents will see something and come in and I want this. Because of internet and things are more accessible. It [assistive technology] is here to stay, and it is, what we need to be doing for all kids and teachers are going to have to do it. Parents are more and more aware of it. It is in the news and everywhere.

Lisa and Mary credit the parent as being a member of the IEP team, but parents have limited input regarding the consideration of adopting and utilizing assistive

technology to meet the needs of their students with disabilities. Mary shared her comments about parent involvement.

> Parents do not question this [assistive technology] because parents don't really understand the IEP. They are so overwhelmed when they get to that meeting they are just beyond asking questions. And that question [pertaining to assistive technology on the IEP] to them, they have no idea what that is. They do not know what AT is because we [teachers] have a hard time understanding what it is because we are not really trained that hard in it.

However, Mary also reported that she had an assistive technology request from a parent of a student that struggled with the physical act of writing. These parents requested a laptop for their student to take notes. After the parent made this suggestion, the IEP team decided it was a benefit for the student and set up a laptop computer for the student to use. Despite this instance, Mary reported very little parent involvement. Like Mary, Lisa stated limited parent involvement.

At the time of the first interview, Lisa had facilitated only one IEP meeting. However, by the third interview Lisa had completed seven out of nine of her students' IEPs for the school year. After these seven, Lisa still reported that she had not had much interaction with parents pertaining to assistive technology. When the IEP team discussed the consideration of assistive technology on the IEP, Lisa shared this conversation. "Yeah, that section where you check the box, I would just say we have no AT and we move on." Lisa indicated the IEP team had checked the box on all seven of the IEP meetings. The parents do not add any input into the discussion. "We just move on, and it is good." Lisa reported she has had only one of the possible seven students attend an IEP meeting. "I have had a 4th grader be there, [at an IEP meeting] but he had to come with his mom." Lisa elaborated on how she would explain assistive technology to a parent.

> Resources that can help your child better their education, including the type of resources their child was using. Or an array of what resources they were using or what they could be using. Like if we were in an IEP meeting, and this might help your child, and talk about this and this and this. And we found out this works better. So high and/or low, I think it would depend on what the child was using or what we tried.

After further probing by the researcher to understand what types of assistive technology Lisa was currently using with students in her classroom, Lisa shared what low- tech assistive technology devices are being used with students.

> Ummmm just like with the autistic student I have suggested it because obviously, I have suggested it because he has been autistic all his life, and it is not like it is anything new... just like their visuals and stuff like that. His para just made him a little sticky note that said listen to speaker or listen because he is sometimes like aaah, so just like little visual things. And, I mean, those are the lowest of low that you can use, but they are very effective. And like the paper I have talked about that we had used with that one student. We talked about it in his IEP.

Students

Lisa and Sara shared how the use of assistive technology was impacted by the student. Sara reported, "I thought this Kurzweil would be the answer to everything, but it was not. The kids didn't like it. I have a talking phone, but no one uses the phone anymore; they use cell phones." Sara realized students make a choice and said, "Sometimes I spend all this time getting something ready on the iPad, and then the student would get out of it." Lisa reported how she may think a certain piece of assistive technology may help a student, but the student has made the decision to not use the device.

> One of my students that was new this year, one of his assistive technologies was just lined paper. I think it is more his attitude if he wants to write nice or not, so we just kind of discontinued it because it wasn't really helping. He was like [in kid's voice], 'If I want to write nice, I will; if not, I won't;' so that was that.

Sara reported, "Some of my students know they want to be like all the other students, and I must consider this." Lisa also reported how a student needs to feel an assistive technology device is age appropriate. "A sixth grader didn't want to do it because it is stupid; 'This is baby, why do I have to listen to this?' So I just feel like students, they don't want it, and it is their choice." Lisa had unsuccessfully tried highlighter tape with a student. "He doesn't want to use it." Lisa felt that students at this age have a choice in how they learn, and though it may be a barrier to their learning, "students have that right."

Some of Sara's students are able to advocate for themselves. Most of her students attend the IEP meeting, but it is usually a family choice.

> Some students are able to explain certain parts of their IEP. For example, they can demonstrate using the assistive technology devices. They are able to show what they have mastered on their goals. I would say my students that are verbal could show how and explain the assistive technology; the nonverbal students can demonstrate some but may need verbal prompts or visual prompts. The verbal students share everyday experiences with their parents because I will usually get a text or a phone call asking follow-up questions about the device.

Mary currently has students in the kindergarten and first grades, so she does not have students attend their own IEP meetings. Mary said that although the older students she previously worked with did attend their own IEP meetings, they very rarely suggested an assistive technology device. Mary reported the only time a student did make a request the student quickly made the choice to stop using the device. "I had one kid request an Alphasmart, which was fine because it was good for the student to type the notes, and it fizzled out very quickly." Students were making choices in utilizing assistive technology.

Principal

All three of the participants reported the importance of their principal in the consideration of adopting and utilizing assistive technology for students with disabilities. Sara summed it up with, "I love my administration, they support the kids."

Mary described the role her principal plays in the process she uses when she finds out about a new piece of assistive technology. Mary stated, "I would go talk to my principal and tell her my case and why I think it would be useful, and most likely we would get it and test it out. She is really good about that."

Defining the assistive technology device as a larger expenditure, Mary reported her principal would be supportive. "If it is really what is best for the student, we would find a way to make it work ....the principal is really about what the child needs is what the child gets." Mary expressed,

> My principal is one of the biggest supports I have. She is at all the IEP meetings to help us with those. It is a rare occasion if she cannot be there. She definitely takes part in those conversations. And if I went into her and said, okay, this is the issue I am having with this little kiddo and I need suggestions, then she will either sit there and brainstorm with me or say, okay, this is the best resource at AEA, and let's call them, or maybe we need to get a training for this. Or she just really shoots ideas around for us to get the information we need for a child.

Lisa shared an example of how her principal played an important role in decisions pertaining to assistive technology. "Well, I know of one student, and we were wondering if he had trouble sitting, and so I went and talked to my principal, and she gave me one of those seat things." Lisa shared that the principal knew this information because she used a wiggle seat personally. "She has one herself and she has quite a few actually, and so

just personal experience and she has had it and that is why she can help." Lisa goes to her principal for purchasing items. "For purchasing stuff she is the go to just because she is the principal. And if hers would be an issue then you would probably just go talk to the superintendent." Lisa described the process she moves through to consider assistive technology.

> I would probably do a little bit more research on it to see if it would be effective, and then if it was effective, I would see if we have it, and then I would go talk to my principal, and she would be like, yep, I will order it.

Defining the assistive technology device as a larger expenditure, Lisa reported research would be even more important if the assistive technology device was expensive.

> I would obviously do some extensive research to see if it [changes idea] because it is obviously not a trial and error thing. It costs a lot; like, it cost $3000. Uhmmm so really study the research out there to see if it will work and see if there is anything else out there that is comparable, I guess, and cheaper and trial and error maybe. And see if that more cheaper thing would help. See if anybody else would use it; not just for you, but see if it could be used for multiple things, and then approach my principal.

Sara utilized the IEP team including the parents and the student, if possible, when moving through the assistive technology process of consideration of adopting and utilizing assistive technology to meet the needs of the student with disabilities. "We look at it as a team. A lot of times before the meeting I will ask the OT, PT, SLP, and also the parents and student." Sara stated this is not always an easy process. "The team helps me, and we really work together for assistive technology and find things that work. Some of the times we agree and sometimes we disagree, but we work through it." Sara conveyed a sense of unity in the assistive technology process. "The parents are checking on some things, the AEA is looking, and I am talking to people."

Inherited Decisions

Mary and Lisa, fulfilling the roles of traveler and visitor, respectively, are content to accept the assistive technology recommendations they have inherited from previous IEPs or other staff. Mary explained the consideration of assistive technology at the initial IEP meeting. "At an initial IEP [meeting] I have had some insight from the psych[ologist] that maybe they [the student with disabilities] need something." When probing more in depth with Mary about assistive technology at an initial IEP meeting, Mary stated, "Well, our school psych is the AT at AEA, so I think she would definitely give me an idea. I think she would suggest things if they were useful for a student."

Mary outlined the conversation that may happen. "If it is an initial IEP and something was brought up out of the evaluations that were done, then the psych will have that conversation with the parents." Mary also shared, "When we do the initial IEPs, the OT [occupational therapist] is saying writing grips or the sit and move cushion." Mary takes the traveler role as she trusts the information she receives and moves forward. "Well, it needs to be decided as a team, but I think just having people telling you that these things are out there, and that way I can have that conversation with the parents to decide if it is a better choice for them."

Beyond the initial IEP meeting, Mary used the description, "Oh, this is what we have done in the past, so we are just going to click that box and here it is." Mary did comment that she considered the ideas of others by "talking to their [the student's]

speech-language pathologist and maybe their OT [occupational therapist], and, I mean, pulling in everyone's opinion and seeing generally what's best for that student."

Mary stated she used what is on a previous IEP to make assistive technology decisions. Assistive technology "is kind of skipped if it's a child who has a review and it is, yep, they have had this in the past or, nope, they don't need this." Lisa said she used a similar method. "That section where you check the box, I would just say we have no AT and we move on," she mentioned and then laughed.

Lisa shared her experience during her student teaching placements influenced how she addressed assistive technology during the IEP meeting. Lisa only had the opportunity to sit in on one IEP meeting during her student teaching and shared this information. "When we [IEP team] got to the part on the IEP that asks about assistive technology, I think they [the IEP team] just said there was not AT and went on."

During the consideration of a student's need for raised line paper as assistive technology, Lisa reported that observational data would be an important consideration. "I looked at how he would write on the paper, and then I looked at how he would write on the regular paper, and it was the exact same, and so I was like, well, [laughing] it is not helping." Lisa was confident that she did not collect any other data except the observation. "I don't really use any other data." Lisa shared she did not have to amend the IEP to reflect this change. "It was listed on AT as raised paper, but he was actually the student that just moved, so I didn't have to do anything with it."

Additionally, Sara shared how the IEP goals were an important factor in the consideration of adopting and utilizing assistive technology for her students with

disabilities. "For assistive technology, I look at my goals and then if there is something we can use, we try to figure it out." Sara investigates the assistive technology thoroughly. "I really look how I can build it into the student's day, and really look at the accommodations and look at their goals and look at is it truly being used as assistive technology."

As a traveler, Mary was not looking for the discovery but looking instead for the already discovered, and Lisa, as a visitor, was happy to accept the decisions she inherited regarding assistive technology. Both of these participants shared similar examples of the assistive technology process. In addition to seeking assistance from the IEP team, Lisa, Mary, and Sara also relied on other resources.

Reliance and Resources in the Assistive Technology Process

All three of the participants shared that colleagues are one of the resources on which they rely. Other resources included students and technology.

Colleagues

Lisa reported her colleagues were a resource for obtaining knowledge regarding assistive technology and mentioned both of the other participants in this study as resources. "The teacher for students with significant disabilities, Sara, uses a lot of it [assistive technology], so I kind of watch it and see what she is doing so I can learn from her." Lisa also stated, "Other staff is a great support, and having Mary as my mentor and right there and having my principal and my paras. My paras are super duper helpful." In regards to her mentor, who is Mary in this study, Lisa commented, "Just going to her and shooting my ideas around or asking for ideas. Like the pencil thing. Like, Mary, what do

you do with this? What do you suggest for this? I lean on her." Lisa was scheduled to observe her mentor, Mary. "I know I am going to watch Mary half a day just to see because I know she has a lot of good ideas and the lower elementary teachers I am sure have a lot of good ideas."

Mary credits her AEA team as a resource for her. "I would probably sit down with my AEA person and see if we could discuss it [assistive technology]. I would obviously be calling the parent and seeing if we could try it. There is not a set checklist to do." She also said, "Well, it needs to be decided as a team, but I think just having people telling you that these things are out there helps."

Sara also reported her colleagues are resources for each other. "If we read something, like a lot of us do, we send out an email to everyone and so all get it. We are lucky we can share that way. Email has made a big difference that way." If anyone gives Sara a suggestion regarding assistive technology, she readily agrees to explore. "I look at the information, and then I am going to go ask. I am going to ask my OT, my speech language person, and I am going to ask my PT." Sara is not a mentor right now but is always willing to share and learn from others. "Lisa is a new teacher, and she is in my room a lot. We bounce things back and forth a lot. I will admit I am older, and she is really big on the iPad, so that helps."

Students

Lisa and Sara reported ways in which students are resources regarding assistive technology. Lisa observed students using a variety of assistive technology devices in Sara's classroom. Lisa shared this comment when she told about one of the students

using a switch to communicate. "The one, the boy in the wheelchair, he has this button. It is big, and it is so cool!" Lisa reported she learned about assistive technology when she visited the classroom which served students with significant disabilities. "They have the visuals. Like on the lights, they have no touch." Lisa learned from the students. "The students actually using things [assistive technology devices] was helpful."

Sara reported she has utilized the general education students in her school district as a resource. "These students show me how to get it [assistive technology device] running and how they use it. I then take how they may use it and then modify it for my students." Students can play a useful role in utilizing assistive technology.

Technology

Lisa and Sara both reported technology as a resource. Lisa said, "Well, obviously I am going to go on the internet. Who doesn't go on the internet these days?" Lisa has explored the AEA website. "I can just go to the [Area Education Agency] website and get a list of the classes that they would have about it, and I could go to a class about it."

Sara indicated that technology was a resource for her. She was able to access more information online and appreciated the free downloads. Sara talked about one augmentative and alternative communication app, PrologQuo2go.

> The 30 day trials of things have really helped with barriers. It has cut some of the barriers out because they allow you to download free for 30 days. Like when I was looking at PrologQuo2go, I read the reviews and saw what other people were using and downloaded a free trial.

All three of the participants used a variety of resources to obtain information pertaining to assistive technology. Their assumed roles as visitor, traveler, and explorer defined their experiences in utilizing resources pertinent to assistive technology.

Academic and Student Independence Benefits

With the assistance of the IEP team and the aforementioned resources, Lisa, Mary, and Sara were able to provide valuable benefits to their students. All three of the participants were in agreement that assistive technology provided benefits to students with disabilities. The benefits were categorized into academic benefits and student independence benefits.

Academic Benefits

Sara explained a benefit. "It helps a student complete something they are not able to complete.... There are lower or higher tech; it is just going to help them complete the work." Sara expressed that assistive technology is all encompassing. "Their devices are used to help them speak, for visually, for hearing, and just the mobility part." Sara shared a specific example of using an iPad.

> One of the apps, I have it as part of a student's goal to discriminate between two objects. So it is the same things we did with cards and other materials we made, but the kids are more motivated on the iPad.

Lisa's eyes sparkled when she shared how she was using the iPad and how motivational it was for her students. "Recently I just downloaded some algebra apps because that is what sixth grade is doing now." She said, "They come in the door and ask, can I go to the iPad to do math?" Lisa reported she has perused many apps for the iPad. "I think they are super duper useful in lower [elementary grades] because they have all the phonics stuff and early reading skills." She found "one with prefixes and suffixes and they enjoy that because it has a game to practice skills" for her older students.

Mary reported she was impressed with her iPad, in particular with the academic benefits it provided to her students and with how easy it was to use.

> I think it helps practice some of the skills I have taught. For instance, yesterday I had to do a progress monitoring piece, and while I was progress monitoring one [student], I would have really liked my other two [students] to be working on the iPad on a rhyming activity that maybe graphed how they did so I could see the results afterwards and pinpoint where I needed to work. That way, it wasn't them just doing some wasted worksheets or wasted time so they are actually practicing a specific thing that I taught. I mean, I don't want them to be on there playing a game. I want them to be on there doing specific skills.

Sara's students were students with significant cognitive disabilities, and Sara realized the benefits that assistive technology provides to her students with the statement, "It [assistive technology] is not a choice. It is part of their everyday learning."

Lisa and Mary also shared other academic benefits their students received from the use of assistive technology devices. Lisa projected how assistive technology could provide academic benefits for all students with disabilities and without disabilities.

> I think like your high AT or really just technology is effective for a lot of kids. A lot of higher order thinking will come into play with that because you are not seeing the bare minimum, and it challenges them a little. I think in that aspect, it is not just your special ed kids, it is your higher order thinking kids.

Mary also recognized the value of assistive technology to her students. "I think the pencil grips and things can help them be successful without me sitting there teaching them hand over hand. They can be successful in their writing once I have taught it."

Mary shared how the specific assistive technology devices she previously identified in her classroom benefited her students.

> The Elmo, because they can see the manipulatives, and they can come up and play with the manipulatives, and everybody is able to see it. The Flip [video camera] because I can video tape my kiddo, and he can watch it back and see what he is

doing and like, I would model the skill, and then I tape him doing the same thing and then watch him doing it.

Academic benefits can be achieved through the use of assistive technology.

Assistive technology can have an impact on learning.

Student Independence

Lisa, Mary, and Sara all shared examples of how assistive technology provided benefits for students with disabilities to be more independent. Mary said, "I think it [assistive technology] definitely increases their independence... Socially if we are using the video modeling, yah that has to help tremendously with independence." Lisa reported, "It helps them do things by themselves in the classroom," and Sara stated, "It is one thing that helps kids be more independent."

Mary expressed benefits of visual schedules. "Visual schedules absolutely do [help students socially]. Check lists for their morning routine so when a student walks back into the room, he can do it himself and not have to have someone standing over his shoulder. It makes him more confident." Sara also discussed the benefits of visuals and how they allowed students to be in the general education classroom more. "Using any type of visual schedules, they are able to integrate with their peers more. 90% of my students use visuals; not that they always use it, but it is there." Lisa added that students made transitions by "carrying around a little key ring of cards, and they help." Lisa also shared that visuals helped the students. "Definitely with the visual cues just [posted] across the board just like in Mary's room, I have seen it help students so they know what to do and do not have to ask." Most of Lisa's students are fully included, and she supports the classroom teacher. Lisa reported social benefits, but yet also

contradicted this with the earlier example of how a student did not want to use an assistive technology device that he perceived as not age appropriate. Mary shared assistive technology increases student independence.

> So the child could be more independent [pausing and thinking], not necessarily more independent in here but beyond this room, out in the hallway, in the general education classroom....They can be successful in the room, like the colored overlay or using a highlighter or whatever it is that they need if I teach them in here first, and then they can be successful in the room doing it.

Mary stated, "The success in the general education classroom is very important because that is where we want all students to be placed." Sara also reported the importance of inclusion for her students. Sara's students are included to the maximum level possible depending on the individual students' needs. "I do think that assistive technology has definitely made mainstreaming of students into the regular classroom more possible. It has really helped."

After further probing by the researcher to understand how assistive technology had helped to mainstream students and to increase their independence, Sara reported this information.

> It puts them more with their peers at their level. For example, using a laptop with a speech-to-text device, where they can be in the room, and they may have to go out of the room to answer questions, but then when all are answering in the classroom they can use the device. If the BIGmack is already programmed to say yes/no, then they can use that to respond yes or no. They can participate. There is a big level on the participation. A lot of the devices now are, I don't want to say age appropriate, but the devices are like what the regular ed kids are using, too. It is not like it is so different, and so it is not putting a stigmatism on them. They are kind of blending in. It is like in the big picture, and they are popular, and they are able to complete something of the regular work like their peers.

Mary shared another example of how she perceived assistive technology as providing benefits for a student to be more independent.

> The video modeling, and that we are doing it in here [special education classroom] and we are discussing it, but then hopefully it is generalizing to those other situations because they are seeing those other situations, and it is not just at my table, and that is where it is done at. It is actually them seeing recess time and practicing at recess time, so I think it just helps them generalize it and carry it over to where they are at.

Lisa reported assistive technology assisted in increasing student independence. "More social skills benefits for the autistic student, and then that would then carry over to his academics, and he is able to know what is going on because he is paying attention."

Lisa shared that she enjoyed spending time in the classroom of students with significant cognitive disabilities where she observed how assistive technology benefited students by increasing their independence in the classroom. "You do not have to be verbal with them....just train them to not turn the lights off, or if he wants a drink he has to hit the button, which are the skills they are working on with him." Lisa liked that a student was able to make their own choices without an adult.

Sara agreed with Lisa and Mary and reported how assistive technology also assisted in increasing her students' with significant disabilities independence levels.

> I think students are going to become more independent, and that is a good thing. It is making it more accessible, especially the electronic part. And I think we are always going to have someone like us to make sure if something goes wrong, but they are able to get out more, and I think that is good because that is what we want. Ten or 15 years ago they could not get out and socialize.

When questioned further, Sara shared, "Using the iPads, we have taken them to restaurants, and they can order on their own. I think it is easier for individuals with disabilities using the electronic assistive technology devices to be more mobile in society." She shared how students were also using iPads to navigate their way around the school independently. "I tried to do a little test with an app for one of them to see if he

could get from here to PE, and now he can." Sara was excited to get more iPads so all students could have their own and be more independent.

Limited Awareness of Assistive Technology as a Significant Barrier

Despite the assistance of the IEP team and various other resources enabling Lisa, Mary, and Sara to provide their students with the benefits of assistive technology, the data documented a severe lack of awareness on the part of two of the participants. This lack of awareness was one of the most significant findings of this study. Mary and Lisa each gave examples that were not assistive technology devices or services, which confirmed an original claim in this study that teachers do not have the level of awareness necessary to utilize assistive technology.

Awareness

The participants each defined assistive technology. Lisa identified a curriculum, Reads Naturally, as an assistive technology device that provided academic benefits.

> I think Read Naturally is very helpful, and not me personally, but someone else, said their student was reading like 10 words per minute, and they are up. It just gets them moving and they are up, and I think if I would use Read Naturally and find that time to do it outside of my instructional time, it would really help.

Mary described assistive technology as "any type of device or hands on materials that would help their child be successful in their education environment." She gave examples of Read Naturally and other software as assistive technology. When asked to share assistive technology she has in her classroom, Mary listed a laminator as assistive technology.

Sara defined assistive technology as "any type of device, and it could be electronic or simply like a product or paper, that is going to help a student." Sara's definitions matched the accepted definition of assistive technology.

Observational data revealed a variety of low-tech devices in Lisa's classroom, yet she was not aware that such supports were included as assistive technology devices. Lisa was asked to describe low-tech devices her students use, and she visually scanned her room as if looking for examples and responded, "They don't really use any. They all take typing class, and they are all in tech [class] with computers. They all pretty much do the same things as they are all mainstreamed except for intervention time." Lisa surprisingly responded,

> I don't know about barriers, but the reason we are doing this (research) is because we (teachers) do not know a lot about it, like, there is not a specific class about it. I don't feel like there are barriers just because I don't have the knowledge on it, but what I do see is that it is a lack of information for us.

Lisa's lack of familiarity with assistive technology devices may limit her consideration of assistive technology for her students. In a discussion involving some scenarios of students with disabilities and broad examples of learning situations, Lisa openly replied, "Uhmmmmmm I don't know. Honestly, I don't know about that. But I think that I know there are probably some things out there."

Mary did not readily share any specific examples of low-tech when prompted. However, at the mention of a specific low-tech device, a pencil grip, she relaxed and replied, "Oh yeah, tons of grips in kindergarten and first grade." Then she thought some more and added, "Elevated surfaces for handwriting and putting foam under paper when they are writing too hard." Mary seemed relieved to know she did have some assistive

technology in her classroom even though she had not connected the items as assistive technology. Mary repeatedly stressed she did not have enough knowledge pertaining to assistive technology.

> I think if I had all the background knowledge that was out there, I could use AT. I think it is more that I have to research it and find it versus just implementing it. Like, if you brought it to me, I would figure out a way to make it work.

Although Mary knew she did not have the time to learn about all the assistive technology available, she struggled with this lack of knowledge. Mary repeatedly commented, "Maybe I need to be using more [assistive technology], and I just don't know what is out there." Another time Mary stated, "I don't know what is out there to try." Mary was troubled with her lack of awareness of assistive technology.

> One of the biggest barriers is what you don't know. I don't know what to ask. I don't know what is available. I just don't know what is out there, and maybe these things would benefit my kids (with mild disabilities), but I just don't know what to use. .... When you don't know, you don't know what to ask. I don't know what is out there, so I just do the same thing that I have always done. I can be looking for things, but unless I know exactly what to type into Google or know exactly what to ask the AEA person, I don't know.

Sara was the teacher who shared the most knowledge or awareness of assistive technology, although she did comment, "There is always something else to know about AT." Sara credited her IEP team when asked about the avenue in which she obtained knowledge pertaining to assistive technology. Sara was also the only one of the three teachers that was currently taking graduate classes towards completion of another endorsement and felt this helped her stay informed. She shared that "Learning about AT is just talking to people" and sharing ideas.

Limited College Preparatory as a Barrier

The time frame of how many years had passed since the participants were enrolled in classes to seek their teaching license ranged from one year to 18 years. Even though technology had changed dramatically over this time frame, all three of the participants reported they did not have enough training regarding assistive technology in their preservice programs.

Lisa, being a first year teacher, shared about her experiences with assistive technology while pursuing her elementary teaching certificate and special education endorsement at a small four year private college.

> There was one class [pause]. Let me think. A lot of my classes since they were special ed were night classes and were once a week, and there were only eight or nine students in there. We did talk about it some [thinking]. At [school name] we did have smart board and something like Promo [promethean] board. I used those a lot more in content reading strategies class and my psych classes.

Lisa reported that her professors at the preservice level had limited knowledge in assistive technology, which corresponded with the lack of materials provided to Lisa.

> We talked about AT, but we did not do a lot with it because a lot of the profs were interim teachers, so they were retired teachers or they were teaching during the day, so I don't think they knew a lot about the assistive technology.

Mary expressed she could only remember one conversation pertaining to assistive technology. "I don't remember any in my training; oh, I might have heard it once in my training." Mary clarified that at the time she was a preservice teacher, technology in general was just beginning to expand. "Technology was not huge when I went to school 10 years ago. That is not that long ago, but that is the change of our society." After obtaining her elementary teaching certification, Mary went back to college to complete

her special education endorsement. Mary shared how things she now knows as assistive technology were called "a strategy." "I don't know if they called them AT or we just called them accommodations," she said. She remembered her instructors saying, "Like these would be good accommodations that you could provide." Overall, Mary felt, "at the time it was just more low low things like highlighters, like colored overlays, um, tape recorders to record yourself reading to them."

Sara quickly stated that it was 18 years ago when she was an undergraduate in college and felt "I should say I had enough [training]". Reflecting on what was an appropriate level of training at that time, she said, "So if I look at the beginning, I had probably enough, but back then it was tape recorders, and now there is so much more." Sara recalled the limited information that was shared about assistive technology. "In my undergraduate, just a little bit. It would be like the Boardmaker for schedules. It would be like how to do visual schedules with Boardmaker, so overall not enough information about AT."

Pre-service curriculum materials. Lisa and Mary recalled limited information pertaining to assistive technology in their curriculum materials. Mary reported, "I don't remember if it was in a book, but I doubt it. I am thinking it was a handout they gave us. We did not have to use it in a lesson or anything." Lisa also shared that she did not have any assignments which required her to incorporate assistive technology, but assistive technology was "in a text book like AT is this [spreads her hand out wide], and then the paragraph was over and we moved on to the next paragraph. It was just another paragraph in another book and that was it."

Pre-service field experience. Lisa was the only participant to report working with assistive technology during her required hours completed in area schools. "In my second placement, we had first grade through fifth grade, and my first graders were working on writing, and they had special paper, and that was the extent of it." After further probing into this experience by the researcher, Lisa did share how she felt this special paper was not effective, so she developed another plan.

> Actually she still wrote kind of sloppy, so then what I did is I just got a piece of paper, and I cut up like colored pieces, and I made strips. I put that on there [over the lines], and she could not go off the colored part. Because if she got her pencil on the white it was like, oh no no no! I think I had dashed lines on the colored paper, and so if there was a mark on the white paper, obviously if it was a j it was ok, but if there were any other marks on the white paper, it was like, oh no, that is not good enough, and they would have to erase it. So I think just to use the color, I think I just kind of adapted it.

Lisa reported she was only fortunate enough to sit in on one IEP meeting during her student teaching experience. "I only sat in on one IEP, and she did not use any AT." Lisa recalled how the teacher handled this part of the IEP discussion as "I think they just said there was no AT and went right on." This was Lisa's model of how to address assistive technology in a student's IEP meeting.

Limited Assistive Technology Inservice Training as a Barrier

The three participants all expressed the great professional development they were provided at their school; however, they agreed that this professional development did not generally pertain to assistive technology. Lisa stated, "I don't feel like assistive technology is talked about at all in my school." However, Lisa did recall one opportunity. "In the fall we had a technology professional development day, and we learned more about our mimeo boards."

Mary was confident in the communication channels in which she received information pertaining to special education but not confident in the communication channels pertaining specifically to assistive technology knowledge. Mary shared, "We either get an email from our AEA consultant that works here at our school or our special education coordinator who is our superintendent," when discussing how she receives updated information for special education in general. When asked specifically about the communication channel for assistive technology, Mary laughed, "Hmmm, I would assume it would come through the same manner, but I have not heard much!" Mary used a lot of emphasis on the word "assume" when she shared this information. Mary did not have a clear understanding of why she was not receiving information pertaining to assistive technology in the following example.

> I do not know if that is because I am just in (a classroom for students with mild disabilities), and if I was in (a classroom for students with significant disabilities), would I be hearing more about it [assistive technology] because the needs of the students are different. If that is the issue, I don't know, and maybe I am not seeking it out enough either because we do not need it right at this moment.

Mary shared that she was encouraged to go to trainings. "We try to go to as many as we can, but it is sometimes hard to hear about any trainings about assistive technology." Mary was also frustrated when she did attend a training, and it was not pertinent to what she needed. "I went to a training at the AEA about iPads, but it wasn't anything specific to special education or autism. It was more just here are some apps and I knew all that. I needed more."

Sara did not feel there could ever be enough training on assistive technology. "I feel there is always a need for more information because these devices change frequently,

and our students may change through the school year." Regarding whether they had an appropriate amount of professional development pertaining to assistive technology within the school district, Sara said, "I think yes and no. It depends what is out there. What I need to know for my students and that varies."

Time as a Barrier

The three participants realized time was a barrier regarding assistive technology. Even though all three participants were at different points in their lives, time was a factor of concern in the consideration of assistive technology and in the awareness of assistive technology. Lisa, being a first year teacher, had a large amount of concepts to learn and apply for her students. Mary was at a point in her life that her time outside school was consumed by children and a spouse. Sara's children were grown and her husband traveled a great deal, so she did not have as many constraints on her time outside of school hours.

Time was evident in many of Mary's responses. "The time barrier, I think AT does take time." Mary expressed a limitation to implementing assistive technology was "Time." Mary shared, "I did see a blog online about using the iPad, but I did not have time to follow it." When sharing about putting assistive technology into a student's IEP, time was once again discussed. "I want that AT in there, but I do not want it so specific that I am amending the IEP every month, because this takes time and with these kids it changes. It is tough!" Mary reported.

Although Mary did not directly state it, she used time as a factor to judge assistive technology. The devices Mary listed were very quick and easy to learn or implement.

Later she shared about the Kurzweil and how she was frustrated with the time it takes to use and to trouble shoot with it. "I had 18 kids on my roster, and they all had Kurzweil listed." She also said, "I did not have time to get Kurzweil in. I mean it was horrible! I took it out [of the IEP] because I could not get it in [to the student's schedule]." In another conversation, Mary shared her frustrating experience of actually trying to use Kurzweil and the time it consumed.

> I went to use it the other day, and I couldn't get a darn thing, so I called the lady up in the high school who is an aide and has some time blocked in her schedule to do it and said, I need you to scan this, I don't have time, and I am just messing around with it. She took it and scanned it all in for me, and it worked. She got it to work; only there are still some technical things that are not working. Not good and honestly, it takes so much time.

Mary shared she was waiting for a school psychologist to provide her feedback on a set of apps for her iPad to give her ideas on which ones to use with students. Mary commented it was a slow process and time consuming to find the right apps "because when does she [AEA person] have time to figure out the right apps either." Mary realized that she had limited time to go out and research new assistive technology. "I think if I had all the background knowledge that was out there. I think it is more that I have to research it and find it versus just implementing it."

Sara recognized time as one of the main barriers she has tried to overcome. "You have to find the time, you have to plan the time, and you do it at home," was Sara's statement as she shared that she budgets at least three nights per week to spend on school work.

Sara reported that assistive technology was time consuming in other ways. She talked about the difference in time required to learn certain programs. "I think it is time

consuming, like PrologQuo2go, that app, it takes a lot of time to learn. Boardmaker was pretty quick to learn." Sara expressed that the time consuming category involves more than learning about the technology.

> First you have to set it up, and then you have self-training, and then you have to fix any mistakes. So it is kind of a step by step process. And then thinking it will work, and is it the right one.

Sara shared time could be a barrier as it was sometimes difficult to make judgments about where and how to best spend her time.

> Do I have enough time to use the device with the student while I also have to teach the other students? The app PrologQuo2go, I bought it and thought it would be easy to learn in a couple of hours. It took me two weeks, and then it was practice and retry and practice and retry. I think this is important because you want it to work correctly with the student so they do not become frustrated.

Time was a continuous barrier for Lisa, Mary and Sara. All three indicated that time was a factor in the consideration of adoption and utilization of assistive technology to meet the needs of their students with disabilities.

Explosion

Mary and Sara both reported the rate at which technology was developing was a barrier. Mary said, "Kurzweil was this big thing, and we all got trained on it and spent thousands of dollars, and then the next thing was the iPad." Mary laughingly commented, "My iPad is probably already outdated." Mary reinforced this concern with a great deal of emotion in her voice. "In general it [assistive technology] is changing. Like Alphasmarts, tons and tons of Alphasmarts, and then they were old. The fad of things. We get it, and then it doesn't fit anymore, and then we go to something new." Mary shared, "And technology changes. That is a lot of the problem. It [assistive

technology device} was great at the time we got it, but it is outdated now, and it is time to find something better for the kids."

. Sara shared a concern about research. "We do not have enough research with the assistive technology. The research has not kept up." Self-control is also important. "There are so many things out there, especially with all the apps, and you have to think, are you really going to use that? It takes resistance." Sara also shared trying to stay abreast of assistive technology, in particular the Kurzweil, which her district owned.

> I think another concern with assistive technology is it is changing so fast. Like for example, Kurzweil, do you go with it, or what about the Read Write Gold? You don't know what to go with. I have not used it [Kurzweil] for a couple of years because I did not have a student who needed it. So now I went to use it with a student, and it didn't work. Now we have to go back and try to figure everything out. Maybe fix it and see what is wrong. The big thing is it is changing so fast and you don't know what to jump in on....It is changing so fast, and I think this is making it better for the students because I think students are going to become more independent using all the new things.

Mary also shared that once they had an assistive technology device, it took effort to keep that device updated so it could continue to be used. She compared how easy it was to use the iPad versus the Kurzweil.

> Honestly it takes so much time [Kurzweil], and the iPad is so much easier for me to read something into it, and the kids listen to it that way, and there is just so much involved with the Kurzweil, and it has not kept up with the times.

Explosion was a barrier for Mary and Sara. Two of the three participants indicated the rapid explosion of technology was a factor in the consideration of adoption and utilization of assistive technology to meet the needs of their students with disabilities.

Cost and Matching

Sara also reported that cost and matching were barriers. "Barriers may definitely be the price and is it a good match for my students. Some look really easy to navigate, but after purchase I see they are not a good fit with the student." Sara has tried to have things made to reduce costs. "I go to our industrial tech people, or my husband works in wood work." Although insurance had made it difficult to make items for students to use. "I have all these trip trap chairs and they each cost two hundred dollars. Everything we have we buy because of our insurance issue. Some insurance companies won't cover things that are homemade."

She was very conscientious about spending any money for a device to not be utilized. "Barriers in that something really really looks good, and the barrier that you just don't want it to be on the shelf." A contradiction to cost as a barrier was speculated in Sara's statement of how she considered the cost and the use of an assistive technology item in order to prevent abandonment.

> I have coin-u-lators and I borrowed them from a high school teacher, but I took them back because my students were just not able to use them. And I had a talking calculator, and it does the problem right on there. I used it the last 4 years, and now I have a different type of kids, so I am not using it because it doesn't match my kids. If it doesn't match my students, I will send it on. I will not let it just sit there. Someone else can use it, and it is just taking up space. And I have ordered things in the past that don't work for my students, and I will just give them away so someone else can use them.

Sara was also concerned about age appropriateness of assistive technology devices. "And you always have to think is it age appropriate? ... Like I had an upper elementary teacher say the child really needs a sippy cup, and I said, yes, I understand that, but is it age appropriate?" Cost and matching are factors in the consideration of

adoption and utilization of assistive technology to meet the needs of their students with disabilities.

Summary

All five themes developed from the findings of this study were insightful to aid in answering the research questions. Chapter 5 will add the theoretical lens to the data. Implications, conclusions, and recommendations for further studies will also be included in Chapter 5.

CHAPTER 5

DISCUSSION

Millions of students with disabilities are struggling to achieve academic growth due to a variety of learning problems. In 2011, 12.7% of the student population in Iowa was identified as eligible to receive special education services (Iowa Department of Education, 2011). Not only does the law require the consideration of assistive technology, but the consideration of assistive technology needs is important due to the many benefits that students with disabilities would have available. For most people, technology makes life easier or broadens their horizons, but for students with disabilities, assistive technology may provide the opportunity to increase independent functioning and access the general education curriculum.

Discovering the processes and factors that teachers of students with disabilities use in adopting and utilizing assistive technology can assist teachers in providing assistive technology devices and services to meet the needs of their students. This qualitative study was significant as it adds to the body of knowledge to aid in understanding and becoming aware of the benefits and overcoming barriers as they pertain to the assistive technology process. Three teachers shared their stories of the processes and factors they encountered in providing assistive technology to their students. The three participants represented a range of educational backgrounds, experiences, and professional development opportunities.

The findings of this study suggested there was an insufficient or narrow process available for teachers to consider, adopt, and utilize assistive technology devices

and services and a lack of teacher awareness of assistive technology. While these findings are significant to the field of assistive technology, there were several limitations associated with the data collection and analysis. There were only three participants in this study and each told their individual story. All three of these participants were elementary teachers at the same school and in the same district, which resulted in the natural narrowing of the focus of the study. As noted in the personal statement at the beginning of the study, the researcher was a former special education teacher which could have led to some interpretation bias of the interview data. The last limitation was the results of the study couldn't be generalized.

Three research questions guided this study. The questions and conversations gave the participants an avenue to share their stories as the researcher attempted to determine patterns and themes of the processes and factors that teachers of students with disabilities used in adopting and utilizing assistive technology to meet the needs of their students. The research questions for this study were as follows:

1. How do teachers of students with disabilities characterize the process of obtaining assistive technology devices or services to meet the needs of their students with disabilities?
2. What factors influence the process of adopting and utilizing assistive technology to meet the needs of their students?
3. What resources and challenges do teachers of students with disabilities encounter in adopting and utilizing assistive technology to meet the needs of their students?

All three of the participants shared experiences related to the research questions. Responses to the questions were categorized into five major themes: diversity in shared assistive technology experiences, IEP team guides the assistive technology process, reliance and resources, academic and student independence benefits, and limited awareness of assistive technology as a significant barrier. The findings from the themes diversity in shared assistive technology experiences and IEP team guides the assistive technology process were used to answer the first research question: how do teachers of students with disabilities characterize the process of obtaining assistive technology devices or services to meet the needs of their students with disabilities?

The Process to Consider, Adopt, and Utilize Assistive Technology

One conclusion of this study was that these teachers have an insufficient or narrow process available to them to consider, adopt and utilize assistive technology devices and services to meet the needs of their students with disabilities. While all participants reported that the IEP team interactions guided the process, each teacher utilized a unique and diverse approach to considering assistive technology needs for their students. An important implication of this lack of a systematic and uniformed process is that these teachers may be limited in the exploration of possible assistive technology supports for students with disabilities.

Diversity

The diversity in approaches teachers used to consider assistive technology needs influenced how uniform or structured the three participants' assistive technology process was in this study. All three of the participants brought varied experiences and

backgrounds into this study. Lisa was a first year teacher, Sara's students had more significant cognitive challenges, and Mary had limited time to give outside of the hours of the school day. Sara's preservice training took place over twenty years ago, yet she was the only participant still enrolled in classes during the study. The variety of experiences the participants brought to the study led to the categories of Visitor, Traveler, and Explorer for Lisa, Mary, and Sara, respectively. These categories conjured different descriptions of how each participant shared the process they moved through to obtain assistive technology devices and services to meet the needs of their students with disabilities.

Lisa, as a visitor, was cautious in her new environment. Lisa was taking advice from more seasoned travelers or teachers and trying to fit into the school environment without making a big splash. Lisa started to identify her process as she learned from other teachers, including her one experience during student teaching.

Mary, as a traveler, was happy and content to go along her selected path and fill in with a few things that popped into her line of vision, but not really extend herself off her route. Mary enjoyed new information if someone gave the information to her. Mary's, the traveler, process had been established through her eight years of teaching. Mary did not feel the need to spend the extra time to explore assistive technology in depth. Mary shared how her process involved checking the assistive technology box on the IEP because that is what she had always done. Mary did not recall being taught a process to consider assistive technology for students with disabilities, so she continued with the method of checking the box pertaining to assistive technology on the IEP because that is

what she had always done. Mary conveyed the idea that she did not know what she would look for if her students did need more assistive technology, since she did not know what was available. When Mary did want more information, she trusted others to provide that knowledge to her.

Lisa and Mary's process of obtaining assistive technology to meet the needs of their students with disabilities was loosely structured and narrow. The process did not involve a large commitment of time, as it was usually a decision that happened at an isolated point in time. Mary and Lisa shared that for most of their students, when they got to the box pertaining to assistive technology on the IEP; they checked it and moved on. It did not involve a great deal of discussion or effort and was what they had always done.

Mary and Lisa's processes differed from Sara's process. Sara was an explorer. Sara shared she was continually looking for innovative ideas and studying creative prospects to meet the assistive technology needs of her students. An explorer is a person who finds things and travels in many different directions to discover what they want to know. They are blessed or cursed with this drive to discover. Sara's process of obtaining assistive technology to meet the needs of students with disabilities was more than just a single point in time. Sara was continually searching, implementing, and evaluating assistive technology to meet the needs of her students.

The diversity in the participants' process of considering, selecting, and utilizing assistive technology to meet the needs of students with disabilities reflected literature pertaining to assistive technology. The findings from Bausch et al. (2008) raised

concerns about the lack of teacher awareness of assistive technology in special education teachers. Lisa and Mary repeatedly reported a curricular item, Reads Naturally, when they referred to assistive technology. Van Laarhoven et al. (2008) also concluded a pre-service teacher's knowledge of using assistive technology reflected their comfort level of initiating assistive technology into their instruction and also into the student's IEP. The results of this study showed the importance of having a process to obtain, consider, adopt and utilize assistive technology devices and services to meet the needs of their students with disabilities.

The diversity in experiences and background knowledge influenced the process teachers used to consider assistive technology for students with disabilities. This information was consistent with MacGregor and Pachuski's (1996) findings, discussed in the literature review. Teachers do not have a background in the range of devices and services that are available and have little experience bringing consideration of assistive technology into the IEP process, which creates a wide diversity in the approaches teachers use in the consideration of assistive technology to meet the needs of their students with disabilities.

IEP Team

The three participants reported that the process of considering assistive technology devices and services took place during IEP team meetings. Yet the data revealed that while administrators influenced the consideration process, input from parent and student was minimal and limited. Further, participants shared that the IEP procedure of "checking the box" indicating that assistive technology devices and services were considered but not required, was inherited due to perceptions that assistive technology

was more applicable for students with significant cognitive disabilities. The different members of the IEP team who guided this assistive technology process included administrators, parents, and students. Edyburn (2006) agreed that policies and practices needed to be developed relative to consideration, adoption, and utilization of assistive technology for all students with disabilities.

All three of the participants unanimously agreed the administrators in their school district supported their decisions regarding assistive technology. Lisa reported the principal personally used assistive technology in her daily life. Mary and Lisa shared they could go and talk to their principal regarding assistive technology to get ideas or suggestions or permission to purchase assistive technology items. Mary reported her principal attended a majority of the IEP meetings and was an active participant at the meeting. Lisa, Mary, and Sara all shared their appreciation of their principal.

Dyal et al. (2009) reported that school leaders must be knowledgeable about assistive technology. School administrators must be able to define assistive technology, follow laws pertaining to assistive technology, recognize assistive technology devices and services, identify assistive technology funding sources, and provide professional development in assistive technology (Dyal et al., 2009). This knowledge pertaining to assistive technology allows principals to oversee the process of considering, adopting and utilizing assistive technology devices and services to meet the needs of students with disabilities in order for the student to access the general education curriculum and have a chance for the best opportunities possible. The participants all shared how their principal was knowledgeable regarding assistive technology.

The level of parent involvement was diverse for the three participants. Sara realized the important role parents played in the process of obtaining assistive technology for students and strove to include the parents. Sara gave parents the opportunity to prepare requests or input to be shared at an IEP meeting by sending home letter prior to the meeting. Mary had good attendance from parents at IEP meetings, but parents did not share opinions or ask questions about assistive technology because the parents were overwhelmed and did not understand the IEP. Mary shared that she had only one parent request for assistive technology in her years of teaching. Lisa, at the time of the study, had not yet had any parents request assistive technology during an IEP meeting. All three of the participants realized the important role parents played in the IEP process, but only Sara had parent involvement pertaining to assistive technology.

Research has shown that parents tend to remain passive participants in the development of their child's IEP (Bryant & Bryant, 2003). Efforts to include parents in educational decision making are a core value of special education. Parents also have diverse background knowledge. Hoover-Dempsey, Walker, Jones, and Reed (2002) suggest teachers with limited experiences or skills may not sufficiently solicit parental participation in the IEP process. Some parents have very limited information pertaining to assistive technology while others may have a vast amount of information. Bryant and Bryant (2003) provided strategies for educators to help parents be involved in the IEP process while still respecting the wishes of the parent. The positive difference family involvement makes was stated in an article by Lindstrom, Doren, Metheny, Johnson, and Zane (2007). Jeffs, Behrmann, and Bannan-Ritland (2006) concluded that in order to

infuse assistive technology into the lives of students with disabilities, parents along with school personnel must join forces in listening, learning, and sharing information and resources.

The three participants had minimal participation from students in decisions regarding assistive technology and the IEP process. Mary reported that when she taught students at an older grade level, her students were involved with the IEP process, but only one student had made a specific request for an assistive technology device. Sara's students were involved in the decision-making process to the best of their ability; however, Lisa shared the only time she had a student attend an IEP meeting was because the student had to come with his mom. The three participants all reported students played an insignificant role in the process of determining assistive technology for their use.

Students also play a critical role in determining assistive technology for themselves (Test et al., 2004). However, the rate of student participation in the actual IEP process is low, especially with students with significant cognitive disabilities (Test et al., 2004). Teachers support the concept that active involvement by the students in their own IEP decisions should lead to better outcomes (Dabkowski, 2004; Wells & Sheehey, 2012). However, it is difficult to get students involved in the IEP process at the elementary level. Scherer and Craddock (2002) reported that having the student share what type of assistive technology device they preferred would help to eliminate abandonment, but the students generally do not have information regarding assistive technology.

Assistive technology was an inherited decision for two of the participants in this study. Lisa and Mary's process to determine assistive technology needs for their students were influenced by their preservice training and inservice practices. The consideration process was a habit or routine. When the IEP team came to assistive technology on the IEP, they simply used what they had always used by checking the box the same as previous years. This ritual of checking the box was relevant to Mary and Lisa's perception that assistive technology is for students with significant cognitive disabilities.

The findings from this study address the first research question concerning the process these teachers used to determine assistive technology services. These three teachers reported that the IEP forum guided the consideration process, and yet parent and student input was minimal. While diverse in their approach, these teachers emphasized the role of the administrators in assistive technology consideration. As reported, the process these teachers employed to consider, adopt, and utilize assistive technology devices and services to meet the needs of their students with disabilities could be described as insufficient or narrow. The lack of a systematic, uniform approach may significantly limit consideration of assistive technology supports and may be incongruent with legal requirements concerning the consideration of a child's assistive technology needs.

Factors Influencing the Process of Considering, Adopting, and Utilizing Assistive Technology

The Diffusion of Innovations (Rogers, 2003) and the Technology Acceptance Model (Davis, 1986) were two theoretical frameworks explored for this study. The findings from this study were analyzed through each theoretical lens to answer research

question two: what factors influence the process of adopting and utilizing assistive technology to meet the needs of their students.

Another conclusion of this study was that the factors influencing the process of adopting and utilizing assistive technology aligned with elements from both Rogers's Diffusion of Innovations theory (2003), as well as Davis's Technology Acceptance Model (1986). Aspects of Roger's diffusion elements, innovation characteristics, and the innovation-decision process influenced the participants' consideration of assistive technology as did Davis's perceived ease of use and perceived usefulness. Teachers viewed assistive technology as an innovation capable of addressing problems and perceived administrative support for the provision of assistive technology. Yet the diffusion of assistive technology supports was limited by time and insufficient communication channels for these teachers. While cost was not a characteristic influencing adoption of assistive technology for all three participants, opportunity to see effects or observability was. Most significantly, the innovation-decision process was most influenced by the teachers' lack of knowledge. Another important implication is that without sufficient knowledge, sufficient time, and available communication channels to diffuse information, the adoption of assistive technology innovations will be slow.

Rogers's Diffusion of Innovations

A teacher's consideration of assistive technology may be influenced by any or all of four elements that influence the diffusion of a new innovation: innovation, communication channels, time, and social system. A teacher may not be aware that the innovation itself can provide many benefits to students with disabilities or may have

barriers to obtaining the innovation to be utilized by the individual with disabilities. In this study, all three of the participants supported assistive technology as an innovation, even though two of the participants did not utilize assistive technology to a large degree. Lisa described assistive technology as resources that can help a child better their education. Mary described assistive technology as any type of device or hands on materials that would help a child be successful in their education environment. These descriptions matched Rogers's explanation of an innovation as a new alternative to solving a problem. Sara extended this description to include a setting. Assistive technology helps a student complete something they are not able to complete in a general education or special education setting.

The communication channels available to teachers are variable. A teacher that has a strong support system including an assistive technology team or possibly a mentor or colleague with knowledge pertaining to assistive technology will have the opportunity to diffuse assistive technology more effectively. Teachers who have the opportunity to access information through a viable communication channel will have an advantage to diffuse the innovation. In this study, the participants' responses reflected that the communication channel was not sufficient to keep teachers informed. The communication channels available to teachers were variable. There was an assistive technology team available as a resource to the three participants, but Mary and Lisa were not aware of this team. Sara utilized the assistive technology team and colleagues from other schools. Lisa and Mary repeatedly shared they did not know what was available for assistive technology and they were not receiving this information.

Time is a critical element for all teachers and is usually not an element that teachers can control, given the demands placed upon teachers. Teachers have to invest a great deal of their own time beyond the contracted hours to stay informed of assistive technology. In this study, time was the most critical element influencing how fast the AT innovation was diffused. Mary reported how she was waiting for a school psychologist to pass information on to her. Sara told how she scheduled certain nights a week out of her personal time to just work with assistive technology. If teachers do not have the time or take the time to learn or explore assistive technology options, then diffusion will be limited.

The social structure surrounding a teacher will play a major role in the decision to adopt an innovation. Teachers who are surrounded by a model of practice involving creativity and innovation or problem solving will strive to look for various types of assistive technology to meet the needs of their students with disabilities. In this study, all three of the participants reported their administration as being very supportive of assistive technology, and Lisa even shared how the principal used a piece of assistive technology herself. The social system seemed to involve Mary or Lisa and their principal. This implied a somewhat limited social system of two people or two levels. Sara's social system was more extended and involved her principal as well as other teachers, parents, students, and AEA personnel, making it a multi-level social system.

Rogers's (2003) theory purports that the eventual acceptance of innovations by members of the social system depends primarily on five user perceived innovation

characteristics: relative advantage, compatibility, complexity, trialability, and observability.

Relative advantage is the degree to which an innovation is perceived as better than the idea or device that it supersedes. Factors that teachers might compare include low initial cost; a decrease in comfort, social stigma or acceptance; and reduced time and effort. In this study, cost was not a characteristic of the assistive technology innovation influencing adoption, but stigma was a factor for one participant. Lisa shared how her student did not want to use anything that was different from peers, and he considered it to be baby-like. All three of the participants reported that cost was not a factor in considering an assistive technology device to meet the needs of a student. Cost was unlimited and the school would find a way to obtain a certain assistive technology device if it was necessary for a student to succeed.

Compatibility is the "degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003, p. 15). An innovation that is compatible with the values and norms of the social system will be adopted more rapidly than an innovation that is not compatible. Teachers need to be able to understand the student and his family's values and past experiences during the adoption process. In this study, only participant Sara considered the student and his family's values and past experiences during the assistive technology process. Mary and Lisa did not share examples that reflected they were considering the compatibility of an assistive technology device or any of the following characteristics. The researcher assumed that Mary and Lisa did not have the knowledge or the interaction

level with the parents and student in regards to assistive technology to measure the values or past experiences. The limited conversation which pertained to assistive technology during the IEP meeting stifled any judgment of values.

Complexity is the "degree to which an innovation is perceived as difficult to understand and use" (Rogers, 2003, p.16). Teachers need to explore the level of complexity of an assistive technology device or service as it pertains to how the student may use the device in all settings. The device will need to be easily transported between home and school, and if extraneous accessories are needed, they will have to be available in every setting. Therefore, the simpler an idea is to understand by members of a social system, the more quickly it will be adopted. Only one participant in this study, Sara, explored the level of complexity of an assistive technology device or service as it pertained to how the student may use the device in all settings. She shared how she spent time considering if the device needed to be transported between home and school and if the device was too difficult for a student or his family to use. Complexity was a factor in the diffusion process for Sara.

Trialability is the "degree to which an innovation may be experimented with on a limited basis" (Rogers, 2003, p. 16). If a new idea can be adopted in stages before accepting the whole plan, it will be more quickly accepted. Teachers do not generally have high-tech assistive technology devices available to conduct a trial period. The high-tech devices are more expensive and therefore less available for a trial period. Trialability for the participants in this study may have been limited by the unavailability of an assistive technology state lending library. The AEA has limited assistive

technology devices available for checkout, especially high-tech items. The IEP team would be reluctant to match a student with an assistive technology device without evidence of the device meeting the student's needs. The findings from this study revealed only Sara commented about trialability when she reported borrowing some assistive technology devices from AEA and neighboring school districts and utilizing free 30 day trial downloads to make the decision process easier.

The fifth characteristic, observability, is the "degree to which the results of an innovation are visible to others. The easier it is for the individuals to see the results of an innovation, the more likely they are to adopt" (Rogers, 2003, p. 16). Assistive technology devices will be more readily accepted if another individual with disabilities has utilized the device and had a positive experience with it. In this study, Sara shared how she was fortunate to view a student from another school using an assistive technology device that was being considered for one of her students. Sara was able to observe how the device worked, and this influenced her decision making process.

Rogers's (2003) innovation decision model suggests a process of choices and actions involves knowledge, persuasion, decision, implementation, and confirmation. For this study, the most significant component was knowledge.

In the knowledge stage, an individual learns about the existence of innovation and attempts to gain some understanding of it. During this stage the "individual wants to know what the innovation is and how and why it works" (Rogers, 2003, p. 21). The individual is becoming aware of the innovation and is seeking basic information to begin reducing the level of uncertainty about the ability of the innovation to solve a problem

(Rogers, 2003). In this study, Sara did this by conducting research, reading reviews, talking to other teachers, and utilizing free downloads of assistive technology. Sara was attempting to reduce the uncertainty level. She utilized other students in her school to set up the assistive technology so she could try it out. Sara talked to teachers from other schools, downloaded free trials of assistive technology, and called companies that produced assistive technology devices to discover the advantages and disadvantages.

Mary and Lisa self-disclosed they had limited knowledge of what was available to utilize as an innovation to solve problems for students with disabilities. Mary reported time was limiting her awareness of assistive technology devices and services. Lisa's lack of experiences with assistive technology at the preservice level limited her knowledge level.

In the decision stage, an individual "engages in activities that lead to a choice to adopt or reject an innovation" (Rogers, 2003, p. 177). Rogers (2003) stated that during the persuasion and decision stages, "an individual seeks innovation evaluation information, messages that reduce uncertainty about an innovation's expected consequences" (p. 175). In this study, Sara reported she collected data to confirm her decision regarding assistive technology. Analyzing the data helped Sara confirm her decision regarding assistive technology. Data collection is required by all teachers. Lisa and Sara each shared how their students had made a choice in this study during the decision stage. Lisa's student chose not to use raised lined writing paper because of its age appropriateness. Sara mentioned that she spent quite a bit of time preparing and learning about a program on the iPad, and then the student chose not to use it and quickly

moved to another program. It is not only the teachers that make the decisions; it is also the students.

According to the Diffusion of Innovation theory, a teacher's consideration of assistive technology may be characterized by the time of the first utilization of an idea or innovation. Rogers's theory provided a lens through which to look regarding the process and resources teachers utilized to provide assistive technology to their students with disabilities, and it identified the critical components of adopting an innovation.

Technology Acceptance Model Theoretical Framework

Davis's (1986) Technology Acceptance Model (TAM) has a strong behavioral element and assumes that when someone forms an intention to act, they will be free to act without limitation. In actuality, these limitations are external and include constraints such as limited ability, time, and environmental or organizational structures which could limit the freedom to act. External factors pertaining to teachers who utilized assistive technology in this study included the lack of time and a teacher's limited knowledge pertaining to assistive technology due to limited previous training or ongoing training pertaining to assistive technology.

The Technology Acceptance Model consisted of two technology acceptance measures: perceived ease of use and perceived usefulness. Davis (1986) defined perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (p. 26). Perceived usefulness is related to job effectiveness, productivity, and the importance to one's job. Davis (1986) defined perceived ease of use as "the degree to which an individual believes that using a

particular system would be free of physical and mental effort," (p. 26). Perceived ease of use was "hypothesized to have a significant direct effect on perceived usefulness, with all else being equal, a system which is easier to use will result in increased job performance (i.e., greater usefulness) for the user" (p. 26).

Applying Davis's TAM to teachers of students with disabilities in this study, an assumption could be made that a teacher would pick the assistive technology device that appears to be easier to use and free of physical and mental effort, which would have a positive direct effect on perceived usefulness. In this study, Davis's perceived ease of use could be applied to Lisa and Mary's responses regarding the use of the iPad. Both of the participants wanted an iPad for each of their students. They were enthusiastic about how students could utilize the iPad and how it would be easy to use as teachers. Perceived usefulness pertaining to use of the Kurzweil would have been in the low range for Mary in this study.

Sara unknowingly applied Davis's TAM as she selected assistive technology with parents of students. During this study, Sara considered whether the assistive technology device would be free of physical and mental effort, perceived ease of use, and whether the device would enhance job performance, perceived usefulness. Sara did not appear to consider perceived ease of use or perceived usefulness regarding her personal time and effort required for making decisions pertaining to providing assistive technology for her students. Sara shared how she spent the extra time, trained herself, and explored new options as she explored the best possible options for her students.

A conclusion of this study was that the factors influencing the process of considering, adopting, and utilizing assistive technology aligned with elements from both Rogers's Diffusion of Innovations theory (2003), as well as Davis's Technology Acceptance Model (1986). Aspects of the Rogers's diffusion elements, innovation characteristics, and the innovation-decision process influenced the participants' consideration of assistive technology as did Davis's perceived ease of use and perceived usefulness. Teachers viewed assistive technology as an innovation capable of addressing problems, and perceived administrative support for the provision of assistive technology. Yet the diffusion of assistive technology supports was limited by time and insufficient communication channels for these teachers. While cost was not a characteristic influencing adoption of assistive technology for all three participants, opportunity to see effects or observability was. Most significantly, the innovation-decision process was most influenced by the teachers' lack of knowledge. Without sufficient knowledge, sufficient time, and available communication channels to diffuse information, the adoption of assistive technology innovations will be slow.

Challenges and Resources

Challenges and resources in the process to consider, adopt, and utilize assistive technology were abundant in the experiences shared by all three participants. The findings reported in the themes reliance and resources, academic and student independence benefits, and limited awareness of assistive technology as a significant barrier, along with previous and new literature, were used to answer the third research question: what resources and challenges do teachers of students with disabilities

encounter in adopting and utilizing assistive technology to meet the needs of their students.

Another conclusion of this study was these teachers have insufficient knowledge to consider, adopt and utilize assistive technology devices and services to meet the needs of their students with disabilities. While all teachers reported a variety of resources, there were challenges to overcome. The obstacle of limited knowledge pertaining to assistive technology services is a significant implication of this study and must be overcome and solutions determined to eliminate teacher knowledge as a significant barrier to effective utilization of assistive technology.

Challenges

The process of considering assistive technology devices and services to meet the needs of a student with disabilities was an important part of the reauthorization of IDEA (1997). If the consideration of assistive technology was appropriate and adequate, it could be a crucial support tool in the path to greater independence and integration into the world for a student with disabilities. When the special education teacher did not have the knowledge or awareness to implement this process, the lack of the process became a barrier to successful implementation and utilization of assistive technology to students with disabilities.

Two of the participants in this study self-reported they did not know what was available for assistive technology and when asked, shared an example of a curriculum, Reads Naturally, which they believed to be an assistive technology device. This lack of knowledge of the participants in this study was a significant barrier.

All three participants in this study conceded they had limited exposure to assistive technology at the preservice level. For Mary and Lisa, the limited exposure did not change at the inservice level. Sara, however, took the initiative to learn about assistive technology at the inservice level.

Peterson-Karlan, Hourcade, and Parette (2008) concluded that many current educators lack sufficient knowledge and skills in assistive technology to integrate this resource into programs for their students with disabilities. Hasselbring and Bausch (2005) found that assistive technology is one of the tools and strategies that teachers can utilize, yet too many teachers are not cognizant of the potential of assistive technology to empower students who are struggling to work independently at their grade level. Candela (2003) also determined that teachers are not prepared to use assistive technology, much less teach students how to use it

Lack of teacher awareness of assistive technology at the preservice and inservice levels reported by all three of the participants in this study was similar to results reported in the literature by several researchers (Judge & Sims, 2009; Michaels & McDermott, 2003; Thompson et al., 2000). To increase the preservice knowledge level, all institutes of higher education would need to incorporate assistive technology into their general education and special education teacher preparation classes, field experiences, and student teaching (Martin, 2005). Further research would need to be conducted to measure the impact these increased assistive technology experiences have on a teacher's process of considering, adopting, and utilizing assistive technology to meet the needs of their students.

Knowledge of assistive technology must come from preservice and inservice training. Nelson (2006) reported assistive technology skills should be a necessary component of meeting the teacher standards for all teacher candidates. These skills were not evident in the responses shared by the participants. Michaels and McDermott (2003) found that success and implementation of assistive technology was dependent on assistive technology knowledge, skills, and dispositions of special education teachers. The obstacle of limited knowledge pertaining to assistive technology services must be overcome and solutions determined to eliminate teacher knowledge as a significant barrier to effective utilization of assistive technology (Bausch et al., 2008).

Resources

Another conclusion of this study was there are resources available for teachers to obtain, adopt, and utilize assistive technology to foster academic and independent benefits for students with disabilities. One implication would be to make resources more available for teachers of students with disabilities.

Mary and Lisa utilized resources within their school including Sara, their colleague, and their principal. Sara had a more extensive list of resources including colleagues and materials outside the confines of the school.

Only one participant, Sara, utilized her students' peers as a resource for her. Sara took advantage of the knowledge youth have regarding technology. Sara had high school students set up and demonstrate assistive technology devices for her.

Two of the participants in this study utilized technology as a resource. Lisa searched online for information pertaining to assistive technology while Sara took

advantage of free 30 day trials off the internet. These resources for assistive technology led to benefits for students with disabilities.

Puckett (2004) and Judge, Floyd, and Jeffs (2008) researched the concept of constructing toolkits of assistive technology for teachers. These toolkits included colleagues as a resource. The three participants each utilized a variety of resources. These resources helped the participants in this study provide assistive technology to their students with disabilities. The Wisconsin Assistive Technology Initiative (WATI) also suggested many resources pertaining to assistive technology for teachers (Reed, 2004). These resources include websites, journals, newsletters, books, videos, and different vendors of assistive technology. Listserves have also become a popular resource for teachers (Reed & Lahm, 2005). There are resources available; teachers just need to explore to find resources pertaining to assistive technology.

Benefits

The three participants in this study were in agreement that assistive technology provided benefits to students with disabilities. Academic benefits and student independence benefits via assistive technology were shared in this study.

Two of the participants in this study, Lisa and Mary, reported they believed assistive technology provided academic benefits but they shared limited examples of what these academic benefits were. Sara believed that assistive technology helps a student with disabilities complete a task they could otherwise not do. Lisa reported her students were excited to do academic work on the iPad, but she did not have any data to support improved skill levels of students. Again, Mary and Lisa's ideas that assistive

technology was more for students with more significant cognitive disabilities clouded their understanding of how assistive technology could provide benefits to their students.

All three participants agreed that assistive technology enhanced student independence in this study. Sara shared examples of student independence in the community, and Lisa and Mary reported students using visual schedules to gain independence. Acceptance by other students was also an independent benefit shared in this study. Sara shared examples of how assistive technology provided social benefits for her students as they could be mainstreamed into the general education settings more because they participated and functioned at a level closer to their peers.

One of the greatest benefits of assistive technology may be its capacity to enable students with disabilities to access a task that could not have been done before or reach a specific ambition that otherwise would not have been possible (Copley & Ziviani, 2004). Assistive technology has the power to allow students with disabilities to actively engage in learning with their classmates. In the literature reviewed for this study, researchers and other authorities who were knowledgeable on assistive technology (Behrmann, 1994; Blackhurst, 2005b; Derer et al., 1996; Edyburn, 2005; Todis, 1996) agreed the quality of education and the quality of life potentially improved with the utilization of technology for students with disabilities. Downing (2005) also reported assistive technology could promote valued outcomes within inclusive school settings, including the development of friendships and social relationships. Social interaction benefits gained through the use of assistive technology were reported to include an increase in the inclusion of students with disabilities into the general education setting (Behrmann, 1998; Friend & Bursuck, 2009;

Hutinger et al., 1996). Assistive technology can provide greater opportunities for socialization for students with disabilities (Lahm & Nickels, 1999).

Copley and Ziviani (2004) reported that assistive technology aided a student in performing a task they could otherwise not do. Behrmann (1994) stated that technology could be a great equalizer for individuals with disabilities.

A conclusion of this study was these teachers have insufficient knowledge to consider, adopt, and utilize assistive technology devices and services to meet the needs of their students with disabilities. While all teachers reported a variety of resources, there were challenges to overcome. The obstacle of limited knowledge pertaining to assistive technology services must be overcome and solutions determined to eliminate teacher knowledge as a significant barrier to effective utilization of assistive technology.

Teachers faced challenges and utilized resources to provide benefits to their students with disabilities. The stories shared by the participants in this study provided an answer to the third research question, what resources and challenges do teachers of students with disabilities encounter in adopting and utilizing assistive technology to meet the needs of their students. It is not possible to predict all the challenges and resources for every child, but the information gained from the participants in this study helped outline a discussion of implications and recommendations.

Implications and Recommendations for the Process of Considering, Adopting, and Utilizing Assistive Technology

These teachers utilized an insufficient process for considering, adopting, and utilizing assistive technology to meet the needs of students with disabilities. The lack of a systematic and uniformed process limited their exploration for assistive technology.

The diversified, narrowed approach restricted the consideration, adoption, and utilization of a variety of assistive technology devices and services which may have benefitted their students with disabilities. A limited amount of parent and student participation in the IEP process, related to assistive technology, was reported by the teachers. This limited participation reduced the opportunity for active and meaningful input into the consideration, adoption, and utilization of assistive technology devices and services. Most importantly, these teachers possessed a limited knowledge of assistive technology devices and services. Without this knowledge, teachers will lack the skills and propensities to consider, adopt, and utilize assistive technology to best meet the needs of their students. Based on these conclusions and implications, several recommendations may be offered for the process of considering, adopting, and utilizing the assistive technology process.

First, a school must collectively decide upon an assistive technology process to consider, adopt, and utilize assistive technology and implement with fidelity. Iowa does not currently have a universal model for teachers of students with disabilities to use in the consideration process of assistive technology. The State Assistive Technology Liaison Team, of which the researcher is a member, has recommended the Student Environment Tasks and Tools (SETT) model by Zabala (1995) be combined with questions and checklists from the Wisconsin Assistive Technology Initiative (WATI) by Reed (2004) in order to create the AT Consideration SETT framework posted on the Iowa Department of Education website (See Appendix F). SETT is a guide for considering assistive technology focusing on four explicit areas: (a) the student, (b) the environment, (c) the

tasks required for active participation in the environment, and (d) the tools that enable the student to access environments, participate, and gain skills or enhance performance. The intent of the SETT framework was to provide a set of guidelines to aid in gathering data and a place for educators to start to make decisions regarding assistive technology needs of a student (Zabala, 1995). The student, his environment, and the tasks required must be reviewed before tools are selected (Zabala, 1995). Thinking about the student, questions should be asked about the student's strengths, current abilities and needed abilities. The environment has a big impact on choosing the appropriate assistive technology device. Questions about the environment might include information on current availability, physical arrangement, available supports or resources, and possible changes (Zabala, 1995). Looking at the task identifies what takes place in the environment, what activities support the curriculum and how these activities might be modified to accommodate the student's needs.

Once the student, the environment, and the task have been considered then the discussion regarding the tools can be initiated (Zabala, 1995). This discussion will be addressed towards problem solving what types of assistive technology tools will best meet the student's needs and how these tools will be tried out. Including all four components in the quest to provide assistive technology for a student with disabilities will lead to the best solution for the student.

The WATI is a set of questions and checklists which can be used to complete the SETT framework. A school could decide to adopt this framework to meet the legal

obligation of an IEP team to consider whether a student with disabilities requires assistive technology devices and services.

Second, the current IEP template should be modified to include the documentation of this agreed upon framework. If this universal framework was being utilized, the framework could become part of the IEP. When the IEP team "checked the box" that assistive technology was considered, a link could be created that opened the AT Consideration SETT framework documents as part of the IEP. This would allow the IEP team to complete the documents at the meeting or import the documents that were previously completed for the student with disabilities. Using this AT Consideration SETT framework would create the opportunity to have a uniform assistive technology process within a school and help teachers know where to start to look for information pertaining to assistive technology. The questions on the WATI could guide the conversation of the IEP team as they are considering assistive technology. Examples of assistive technology devices are also listed on the WATI, which could provide a basic list of assistive technology teachers could explore.

Third, student and parent involvement in the IEP process could be increased by introducing teachers to a student-led IEP model. A student-led IEP is an Individualized Education Program that is developed by the student with support and guidance from other members of the IEP team. The student is seen as an equal team member. Preparing students to lead their IEP meeting provides a perfect, real opportunity to learn and practice critical life skills (Hawbaker, 2007). Successful life outcomes are associated with self-advocacy and self-determination (Test et al., 2004). Student-led IEPs teach

students to take ownership for their own education. Students conducting student-led IEPs are developing an understanding of their disability and strengths and gaining and increase in self-confidence or self-efficacy and the ability to advocate for themselves (Mason, McGahee-Kovac & Johnson, 2004). When a student's self-efficacy increases, the student will become a better self-advocate and go out and seek resources to overcome their weaknesses and enhance their strengths. A series of six sessions were outlined by Mason et al. (2004) to guide teachers to prepare students to lead their IEP meetings. The success of obtaining and utilizing assistive technology would be more positive when students have been involved in the consideration process of assistive technology in order to lead their IEP meeting. Students with disabilities would need to understand the assistive technology consideration process before they could share that section of the IEP.

Parent engagement tends to increase with student-led IEP meetings (Hawbaker, 2007). Parents are proud of their student with a disability which creates a less intimidating climate. Parents feel more comfortable addressing questions to their child and feel the IEP meeting is more of a team effort when students are taking the lead in their IEP meeting. Diliberto and Brewer (2012) reported that parents who are active IEP team members help teachers better empathize with the student and the family. Dabkowski (2004) explored IEP team attitudes and practices and recommended points to consider in safeguarding active parent participation in the IEP meeting. Collaboration and support for parents needs to be reinforced, beginning with the initial contact, in order to sustain equitable team membership (Dabkowski, 2004). The success of obtaining and utilizing assistive technology would be more positive when students have been involved

in the consideration process of assistive technology in order to lead their IEP meeting. Students with disabilities would need to understand the assistive technology consideration process before they could share that section of the IEP.

Finally, findings from this study suggested preservice teachers' level of knowledge of assistive technology must be expanded. Professional development for practicing teachers must be strengthened and differentiated to enhance the assistive technology skills of teachers of students with disabilities.

Preservice

To increase the preservice knowledge level, all institutes of higher education would need to incorporate assistive technology into their general education and special education teacher preparation classes. Pope, Hare, and Howard (2005) and Nelson (2006) recommended increasing opportunities for preservice teachers to be exposed to assistive technology devices as they were learning teaching practices in their methods courses, to have experiences with assistive technology during their student teaching, and to see assistive technology being modeled by their supervising teachers. To properly infuse assistive technology into teacher preparation programs throughout all classes may require a complete overhaul of courses so content is more integrated and aligned with assistive technology standards (Judge & Simms, 2009). Including general education and special education preservice teachers in experiences with assistive technology would strengthen the knowledge level of all teachers (McLaren, Bausch, Ault, NATRI, 2007). Michaels and McDermott (2003) recommended assistive technology competencies be developed. However, Brzycki and Dudt (2005) reported the technology competencies

had been developed, but a limited number of teachers knew about these competencies. Although preservice teachers use technology extensively, their use of technology is mainly related to their social communication (Lei, 2009). The Technology, Pedagogy, and Content Knowledge (TPACK) model was introduced by Marino et al. (2009) and added assistive technology as a means to promote inclusive educational practice for preservice teachers. The goal of TPACK was to improve learning outcomes for students with disabilities by boosting preservice teachers' abilities to integrate assistive technology within instruction and assessment.

Stachowiak and Estrada-Hernandez (2010) shared the University of Iowa's hands-on assistive technology model for all preservice teachers in the College of Education. Early evaluations reported by Stachowiak and Estrada-Hernandez (2010) indicated the Iowa model was having a positive impact on students' assistive technology knowledge and comfort level. Judge and Sims (2009) also supported the need to have a range of assistive technology devices available for demonstration purposes and to use during practicum courses.

Providing opportunities for preservice teachers to interact with a variety of assistive technology devices would be beneficial. Opportunities could involve visiting the Easter Seals Camp in Iowa, the assistive technology lab at the University of Iowa, or the AEA media lab. Perhaps inviting the AEA Assistive Technology Contact person to come and speak during preservice classes would be an option. Taking advantage of webinars, webquests, (Manning & Carpenter, 2008) or requiring preservice teachers to explore Atomic Learning might be other avenues to increase assistive technology

knowledge at the preservice level. An increase of knowledge pertaining to assistive technology needs to begin at the preservice level and be continued into the inservice level for all teachers.

Inservice

Teachers providing instruction to students with disabilities must understand and use strategies for determining assistive technology outcomes and have a working knowledge of how to effectively use a variety of assistive technology devices. In Iowa, there is an Assistive Technology Contact within each AEA. This is referred to as an expert model. This AEA Assistive Technology Contact is an assistive technology expert, but this expert does not provide direct services to students requiring assistive technology and is not in the school to provide day-to-day assistance for teachers. The experts are only brought into a school building once a referral has been made by a teacher. Lisa and Mary had shared they did not know what was available for assistive technology. If a teacher does not know what is available, it would be hard to complete a referral in order to instigate correspondence from an AEA Assistive Technology Contact. Parette, Peterson-Karlan, Wojcik, and Bardi, (2007) suggested implementing user groups to expand the base of effectively prepared professionals so schools were not dependent on experts. Teachers have a mandated obligation to increase their understanding of the assistive technology process to ensure effectiveness on IEP teams.

Iowa currently has a mentoring system in place for first and second year teachers. For teachers of students with disabilities, this mentoring system needs to be refined to ensure beginning teachers are receiving materials and information pertaining to special

education and gaining access to information to answer their questions regarding assistive technology. Mary was Lisa's mentor in this school district. Mary had taught for eight years but did not appear to have any more knowledge regarding assistive technology than Lisa, a first year teacher, did. Providing effective training for teachers to be mentors would in turn ensure quality teachers with assistive technology knowledge.

The participants in this study reported their principal as their best resource; however, the principal is a member of the IEP team and not a resource for assistive technology. The principal was the person who controlled the funds for the participants to purchase assistive technology devices. If principals were to become a resource for teachers of students with disabilities to seek out when they had questions pertaining to assistive technology, a principal would need to have the necessary training. Incorporating assistive technology training into the Iowa Principal Leadership Academy would allow the principal to have a basic understanding of what assistive technology devices and services are or where to seek more assistive technology information for teachers.

Just like students, teachers need differentiated instruction. Teachers need professional development training to stay informed on the latest assistive technology devices and services. Differentiated instruction would maximize learning for all teachers and create meaningful training opportunities. Teachers of students with disabilities could construct a personal growth plan pertaining to their assistive technology knowledge. Teachers could then pool their ideas and problem solve on how to obtain their goals.

Assistive technology experts could be brought in to assist with this differentiated professional development, and principals could allocate the resources needed.

Many resources are available for teachers to learn about assistive technology. An assistive technology lab is available at the University of Iowa, where teachers could actually try out devices. Atomic Learning is a web-based program that has short informative tutorials on how to use a variety of technologies including assistive technology devices. Atomic Learning is available free to teachers in Iowa through AEA on-line libraries. The Quality Indicators of Assistive Technology (QIAT) list serve maintains a dialogue of questions and answers from participants all over the world. Webinars have become a very popular source of information, and many of these webinars are free.

The process to be informed about the above mentioned resources could be accomplished through an on-line repository of information available to Iowa teachers of students with disabilities. This repository could be maintained by AEA assistive technology contacts. By pooling everyone's information into one area, teachers and students would benefit immensely.

The Law and Changes in the Process for Considering, Adopting, and Utilizing Assistive Technology

Legislative acts including The Tech Acts, ADA, and IDEA revealed significant and numerous federal initiatives to ensure individuals with disabilities were afforded equal educational opportunities through the provision of assistive technology devices and services. In order to meet the requirements of the IDEA, the IEP teams must be familiar with the legal requirements and the expansive array of assistive technology devices and

services available to students with disabilities. One way of providing preservice educators an awareness of laws pertaining to assistive technology would be to incorporate a special education law class into teacher preparation programs. Another way would be to create a curriculum map of education classes to track where assistive technology and the legal requirements were incorporated. Increasing opportunities during field experiences and student teaching experiences for preservice teachers to practice considering, adopting, and utilizing assistive technology and understanding the legal connections would also be a benefit.

Ongoing information sessions including webinars and tutorials specific to assistive technology law could be provided to inservice teachers. Incorporating assistive technology law into a mentor's role may also provide more access to information.

The legislative initiatives illustrate the importance the federal government has placed on assistive technology in the lives of children with disabilities. The combination of the appropriate assistive technology device and assistive technology services can enhance the likelihood of success and overall well-being for a student with disabilities. Teachers need to know the laws and possess the skills to implement these laws and assistive technologies to effectively provide access to the general education curriculum and meet the challenge of providing the best education possible for all students with disabilities.

These four recommendations will involve essential changes in the assistive technology consideration process in schools, in student and parental participation in that process, and in preservice and inservice preparation and professional development. In

order to realize these recommendations, Fullan's Change Theory (1982; 1991; 2001) was researched to provide helpful insight into the characteristics of the change process and how educational leaders facilitate change and in regards to the assistive technology process to consider, adopt, and utilize assistive technology devices and services for students with disabilities.

Fullan's Change Theory

Fullan's (1982) theories discuss four broad phases in the change process: initiation, implementation, continuation, and outcome. The initiation phase is deciding whether to embark on innovation and developing commitment towards the process (Fullan, 1991). Implementation is the phase of attempted use of the innovation. Continuation and outcome are the phases when innovation and change stop being regarded as something new and become part of the usual way of doing things. Fullan (1982) identified three areas of the major factors affecting the implementation phase.

Characteristics of Change

The first factor involves the characteristics of change. The characteristics of change include need, clarity, complexity, and quality and practicality (Fullan, 1982).

Need is one of the important characteristics of change. Teachers frequently do not see the need for a change and therefore do not endorse the change (Fullan, 1991). A teacher might not see the need for a change until they are involved with the change process. "Clarity is an ongoing problem in the process of change. "Even when there is a potential need as when teachers want to improve some area of the curriculum, the change may be not at all clear about what they should do differently" (p. 11). The lack of clarity

may also influence implementation. The accomplishment of clarity is dependent on the process. Teachers may identify the need to change, but do not know how to proceed to change. Teachers possibly do not have the resources needed or the knowledge necessary to implement a change. Fullan (1991) defines complexity as the "difficulty and extent of change which might be involved for individuals engaged in implementation" (p. 12). The starting point of an individual, the skill required and the beliefs of an individual are all factors that affect complexity (1991). The quality and practicality characteristic refers to how well the process is defined, organized, and specific to the desired change (1991). Need, clarity, complexity, and quality and practicality are all characteristics that must be considered for each of the recommendations.

Local Characteristics

Change happens to individuals and every change has two components: "an implicit or explicit 'theory of education' (what the change is) and an implicit or explicit 'theory of change' (the process being followed to implement it)" (Fullan, 1982, p.5). For change to succeed, an individual must find meaning in both what the change is and the process being followed to implement the change. The direction of the change can be decided by teachers, administrators, external developers, or other officials, and an individual will go through the same process of examining the meaning of change. This process is "acceptance, rejection, and modification must be confronted and worked through" (p. 5). Fullan (1982) recognizes that changes come from both internal and external sources and "must be assessed on their particular merits from each individual's or group's perspective" (p. 6). Teachers are continually faced with changes, and they

have to make decisions regarding these changes. Do teachers have the resources or support—administrators, colleagues, or outside agency representatives—to make these changes? One of the important people affecting change in an educational setting is the principal. Fullan (2001) outlines five core competencies for leaders to effectively deal with complex change.

Five core competencies including attending to a broader moral purpose, keeping on top of the change process, cultivating relationships, sharing knowledge, and setting a vision and context for creating coherence in organizations, "represent independent but mutual reinforcing forces for positive change" (Fullan, 2001, p. 3). Moral purpose is defined as "acting with the intention of making a positive difference in the lives of employees, customers, and society as a whole" (p. 3). Teachers would define their moral purpose as making a difference in the life of a child or their student. Teachers of students with disabilities are concerned with closing the achievement gap between general education students and students with disabilities. Fullan (2001) believes moral purpose is about both ends and means. In education, if the end is to make a difference in the life of a child, the means are the ways we go about making that difference. How will we make a difference for a child? Is assistive technology the mean to achieve the end for a student with disabilities? Do teachers have the resources necessary to consider assistive technology and make a difference for a child? The difference for a child may have multiple meanings depending on the culture and diverse interests of different groups that have an influence on that child. "To achieve moral purpose is to forge interaction – and even mutual purpose – across groups" (p. 25). Forging interaction is cultivating

relationships and sharing knowledge. Fullan (1991) believed that development of individuals was not sufficient, but would need to expand to groups. Relationships between people with goals are crucial, but only if they work at establishing greater program coherence and the addition of resources. Creating these new relationships initiates an opportunity for sharing knowledge and information. Information only becomes valuable in a social context (Fullan, 1991). By sharing knowledge and information pertaining to assistive technology, teachers could develop new relationships and add new resources to their repertoire. According to Fullan, while achieving moral purpose, change is happening, and understanding this change is critical in the five competencies.

External Factors

Understanding change is messy, pertains to innovativeness, and has great potential for creative breakthroughs (Fullan, 2001). Understanding change is "rocket science, not least because we are inundated with complex, unclear, and often contradictory advice" (p. 31). Accepting the messiness, innovativeness, creativity, and contradictory advice has led to the acceptance that "...change cannot be managed. It can be understood and perhaps led, but it cannot be controlled" (p. 33). According to Fullan, change is also influenced by external factors. Fullan (1991) identified external factors in the educational change process as government or other agencies. One external factor would be law pertaining to special education. Throughout history, the federal government has played a critical role in requiring considerations of assistive technology needs for students with disabilities. Teachers need to know the laws and possess the

skills to implement these laws and assistive technologies to effectively provide access to the general education curriculum and meet the challenge of providing the best education possible for all students with disabilities. As these teachers define a sufficient process to consider, adopt, and utilize assistive technology devices and services, it will help them to meet the intent of the many of the pieces of legislation addressing students with disabilities. Federal law mandates that the IEP team consider whether a student with disabilities requires assistive technology devices and services. From the Technology Related Assistance for Individuals with Disabilities Act of 1998 to Assistive Technology Act of 2004 and from IDEA 1990 to its reauthorizations in 1997 and 2004, provisions for assistive technology devices and services for students with disabilities were well established. All teachers should be aware of their obligations to the laws pertaining to assistive technology. IDEA (1997) required the IEP team to consider whether a child requires assistive technology devices and services.

Another external factor is the levels of the education system in Iowa. The Iowa Department of Education (IDE) operates from initiatives directed by the United States Department of Education. The IDE passes this information on to the Area Education Agencies (AEA) throughout Iowa, which then disseminates the information into local school districts. The recommendation to modify the current IEP template to include documentation of an agreed upon assistive technology framework would be impacted by these external factors.

Fullan (1982) proposed that internal and external factors influence the rate of change. How might these factors influence the recommendations proposed? Change

could happen at the local level by agreeing upon an assistive technology process and increasing student and parent involvement in the IEP, but to change the IEP template would involve moving back up the channel to the Iowa Department of Education. How do the internal factors such as a teacher's work load influence their willingness to change the assistive technology consideration process? Changes to the assistive technology process might require that teachers' workloads be modified and that administrative support for a changed assistive technology process is clearly apparent. This change is possible, but it involves the consideration of the extra levels as external factors. Teachers and AEA personnel will need to have input into the modification of the IEP template through the Iowa Department of Education.

Teachers and the Change Process

In Fullan's (2007) more recent work, teacher learning is explored. Fullan (2007) believes that improvement in the education profession depends on a "radical shift in how we conceive learning and the conditions under which teachers and students work" (p. 35). A radical change in the concept of what teacher learning should entail is supported by Fullan's (2007) five key ideas: professional development is an obstacle in teacher learning; the teacher's learning needs to take place in the work setting; teachers need to be constantly learning to impact student learning; teachers need to work together toward improvements; and working conditions for teachers need to improve. Fullan (2007) agrees this desire to make changes to be successful is driven by moral purpose but also requires personalization, precision, and professional learning by teachers.

> Personalization involves understanding and addressing the individual needs of each student as these appear day-by-day, week-by-week. Precision consists of

> meeting these learning needs in a focused, effective way, again as the needs occur and evolve – timely, on-the-spot precision, not packaged prescription. We then conclude that personalization and precision as just defined cannot possibly occur unless every teacher is deeply immersed daily in learning how to do this, all the while adapting to the dynamic learning needs of students, all the while getting better at meeting those needs (p. 36).

Fullan's concepts would indicate that professional development to increase a teacher's knowledge of the assistive technology process and the ever expanding assistive technology devices and services would need to be provided in the school, at regular intervals, and that teacher learning communities are established to permit school-based groups to work together in acquiring assistive technology knowledge. Professional development would be differentiated to accommodate the visitors, travelers, and explorers of assistive technology. Teachers' strengths with specific assistive technology devices could be identified to create a system of resources for all teachers from which to draw. Opportunities for mentoring and coaching could be explored in regards to assistive technology. By utilizing the assistive technology skills and strengths of easily accessible teachers teaching within the same district or building, reliance on AEA or other outside agencies could be eliminated.

What Leaders Need to do to Facilitate Change

Quality leaders are faced with mastering Fullan's (2001) four leadership capacities: moral purpose, understanding change, developing relationships, and building relationships, in order to foster change. Change is caused by disturbance, and the key phrase to obtain the appropriate amount of change is "disturb them in a manner that approximates the desired outcomes" (p. 109). Fullan (2001) cautions that "taking on all innovations that come along .... is not the kind of disturbance that is going to

approximate any desired outcome" (p. 109). In relation to schools, "the main problem is not the absence of innovations but the presence of too many disconnected, episodic, piecemeal, superficially adorned projects" (p. 109). Leaders need to determine the proper balance between accepting too many innovations, causing a constant overload and fragmentation, and letting too many go, which could lead to stagnation (Fullan, 2001). School leaders are faced every day with challenges involved with change. Fullan's theories can help guide these leaders through the process of change to cultivate positive impacts on all students. Sparks (2003) conducted an interview with Michael Fullan, in which this comment was given: "teaching is an intellectual and scientific profession, as well as a moral profession. That means that schools have to constantly process knowledge about what works and teachers have to see themselves as scientists who continuously develop their intellectual and investigative effectiveness" (paragraph 20). Fullan realizes the constraints placed on teachers and acknowledges that teachers have to set priorities on a reasonable amount of innovations that will be initiated.

Changing the assistive technology process to consider, adopt and utilize assistive technology should involve moral purpose of making a change, keeping on top of the change process, cultivating relationships, sharing knowledge, and creating coherence in the organization. For example, administrators must illustrate that changing the assistive technology process may achieve a moral purpose of making a difference in the life of a child with disabilities. Administrators must facilitate time for teachers to develop relationships to be utilized as learning networks to share information and create a sense of unity and capitalize on the strengths of others. Administrators will need to address

resistance to the proposed change by promoting positive relationships and encourage collaborative conversations to foster the transfer of knowledge. Administrators would need to allocate time for inservice teachers in order to overcome one of the challenges, time, reported by the three participants in this study. Strengthening the knowledge level of preservice and inservice teachers would ensure that students with disabilities have access to the general education curriculum in the regular classroom, as mandated by IDEA. The importance of making all staff members who are working with students with disabilities aware of assistive technology available and providing training related to assistive technology is essential for successful change.

By collectively deciding upon an assistive technology process for considering, adopting, and utilizing assistive technology, modifying the IEP to include documentation of this process, increasing parent and student involvement in the process, and strengthening the knowledge base of teachers at the preservice and inservice levels, more students with disabilities would benefit from assistive technology.

Summary

This research attempted to grasp the essence of the process utilized by teachers of students with disabilities to obtain assistive technology devices or services to meet the needs of their students. The resources and challenges teachers encounter in adopting and utilizing assistive technology to meet the needs of their students was explored. This study took the format of a qualitative research study. Three participants were asked to participate in this study, which employed in-depth individual interviews as the primary means of gathering data.

The knowledge that emerged from this research indicated that participants were challenged to define assistive technology and describe the process utilized to obtain assistive technology. Findings derived from the participants' responses also suggested there were resources utilized and challenges experienced that related to adopting and utilizing assistive technology to meet the needs of students with disabilities.

Technology will continue to have an important role to play in school systems. The special education population and inclusion practices are growing, as is the need for greater access, awareness, and training in assistive technology. Teachers will need to challenge themselves to explore assistive technology devices and services that will increase academic, social, and self-management benefits for students with disabilities. Assistive technology devices and services offer a variety of potential solutions for students with disabilities to alleviate their learning difficulties. Students with disabilities deserve the right to be able to utilize assistive technology as a tool to access the general education curriculum or to access a task that could not be done without assistive technology.

PERSONAL REFLECTION

As I approached the end of my doctorate program and my dissertation, I stopped to reflect on the long journey. There have been ups and downs along the way, (more than I would like to admit) but the focus that has helped me move along this journey is the desire to support teachers as they learn about the assistive technology process and appreciate the benefits assistive technology could provide to students with disabilities.

This study has expanded my knowledge of the process of considering, adopting, and utilizing assistive technology to meet the needs of students with disabilities. My awareness of the barriers including the lack of an assistive technology process, time, and availability of resources including professional development has increased. I am concerned that changes regarding the assistive technology process will need to take place in order for teachers to consider, adopt, and utilize assistive technology to further enhance the lives of students with disabilities. The literature reviewed in conjunction with the results of the data collected and analyzed during this study has provided more incentive for me to increase my students' awareness of assistive technology devices and services.

I am anxious to complete this stretch of the journey and start on a new path. This new path will involve creating resources and opportunities for preservice and inservice teachers to expand their knowledge regarding assistive technology. I truly believe that all teachers need to be aware of assistive technology process in order to assist their students with disabilities to take advantage of every possible opportunity available.

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APPENDIX A
FIRST INTERVIEW EXAMPLE
Date: January 3, 2012

Introduction:

Introduce myself
Talk about Special Olympics and other common initiatives
Discuss topic and Purpose
Stress Confidentiality

Original Questions

1. Tell me about yourself: How many years since you received your initial teaching license? How many years have you taught? Years in special education? What are you licensed to teach? What endorsements do you hold?
2. What does the term assistive technology mean to you?
3. What is your role regarding assistive technology?
4. What type of assistive technology training have you participated in?
5. What type of assistive technologies do you use with your students?
6. What is the process your school uses to "consider" assistive technology
7. Who or what are your best resources pertaining to assistive technology?
8. Who or what are your biggest barriers pertaining to assistive technology?

Ideas to expand the questions:

Introducing questions - Please tell me about when you; Have you ever; Do you remember when;
Follow-up questions - Could you tell me more about; What do you mean by; Okaaaay?
Probing questions - Following up what has been said through direct questioning. What do you mean? So would you say? Would you explain that? How did that happen? Could you share an example with me?
Talk to me about Walk me through the process of
Specifying questions - What did you do then; If a parent said.... what would you say;
Direct questions - Do you think? Do you wonder? Do you know? What are?
Structuring questions - Last time we talked about; I would like to talk a little bit about;
Silence - pausing to give interviewee time to think
Interpreting questions - When you say you make your decisions by using ... would it be true to say you make AT decisions by using.

APPENDIX B
INITIAL CODING FROM TRANSCRIPT EXAMPLE
Participant: Mary

I: So you can go to some trainings

M: Yep, I have never been turned down to go to a **training**. If I say i need to go and my

PD as an inservice teacher

principal says go. Like my princ approached me about going to reading recovery training (she doesn't specifically mention any AT training here).

Administrative support

Trainings... we try to go to as many as we can but it is sometimes **hard to hear about any trainings.**

Lack of awareness

I: Do you have an assistive technology coordinator here at the school?

M: Not that I am **aware** of. We have a special education coordinator. We have just a computer guy who is charge of all or our software and all of our network stuff. **I don't think** we have an AT ...no.

Lack of awareness

I: At the AEA do you have an assistive technology coordinator?

I think so but I have not had to call them in. Like I said **we see it more in the (students with significant disabilities) kiddos**

AT is more for students with significant cognitive disabilities

who aren't speaking. Maybe I need to be using more and **I just don't know what is out there.** (Laughing)

Lack of awareness

I: Do you ever have parent requests for AT?

M: **Calculators** (LOL) when I was in fifth and sixth grade but **not really in K-1 level**.

AT is more for students with significant cognitive disabilities

I: So if you were going to show me everything in your room that is AT what would you show me?

M: My Elmo I think because the kids can come up and show things and do things. The interactive white board. **It just suctions to the board it is the mimeo.** My boardmaker software, my flip camera, my digital camera, taking pictures of the kids and then I bought a POGO. I plug my camera right into the usb port **and print the picture right here**....

Lists visible things but not all the AT devices that she or her kids are using.. Lack of awareness? Just knows it works so doesn't think about it? Easy and convenient to use?

I: Tell me what you would describe as your biggest barrier of AT:

M: The **awareness** of it.... what is out there....

Teacher awareness

I would say the "**fad**" of it too. Kurzweil was this big thing and we all got trained and spent $1000s of $s and then then next thing was the iPad. (big drama, hands in air raised voice) In general, it is **changing.** like alphasmarts... tons and tons of alphasmarts and **then they were old.**

Explosion, always changing, rapidly developing

Our program (for students with more significant disabilities) uses it yet for just typing and stuff. I was thinking that I next year I will be regular ed. It is really hard to coteach and to plan with tons of other people. I love what I do but I am ready for the change. The **fad** of things we get it and then it **doesn't fit anymore** and then we **go to something new** (referring back to ? on barrier) like read naturally... we used it a lot and had all the tapes. ...

Fad, always changing, explosion, rapidly developing

APPENDIX C
INTERVIEW 1 RESPONSES CODED,
Follow-Up Questions for Interview 2,
Theoretical Coupling or Link
Third Round Follow Up Questions Example
Participant: Mary

Quote	Coding	Second Round Follow up questions	Theoretical Coupling or Link	Third Round Follow Up Questions
I would help them improve them and if they were having behavior issues I would go to the classroom and help them work through that with parents and classroom teacher and then I would go to trainings all over the United states and bring it back and train my 80 staff so I was in charge of their literacy initiative	A leader Takes charge		What level of Rogers's adopters is this?	
I did not want (a classroom for students with significant disabilities) and so it was kind of like yes I can do that (meaning	Not comfortable with students with more significant disabilities			

teach sped) and I was doing 5th/6th at the time and now I do k/1st				
when my teachers give me back the child's rubric and it is blurting this week and so then I will do a whole [lesson] on blurting with the kids or if our thing was caring we have done a character counts thing so I just kind of tie it in with everything and see what their needs are.	Instructional programming for students on her roster			
The teachers are constantly asking me what do you do about this and I am constantly pulling things and bringing things out and suggesting things to teachers. They are always looking to me to provide a lot of support .	Leader Wants to be accepted Proud and confident of her ability to be a resource for other teachers	What type of AT support do you offer teachers?		You talked about how you provide resources for the teachers and they really need you and depend on you. What type of AT support do you offer teachers?
I never have any	Fiscal or	If you needed a	Structure of the	Reviewing

trouble to purchase things because my one little boy knows how to write his name but he is so meticulous and he erases and erases so I went to my principal and said can I get him a name stamp you know $14 and she said sure order it. I never have issues.	budget Low tech device so low cost Administrative support	piece of AT that required a large amount of money what process would you have to follow? How did you make the decision about the stamp? Is it in his IEP?	social system impacting decisions?	the information about the young boy then… Please share with my how you made that decision?
An iPad for every kiddo in here. I have mine that I just got this year but it is the AT for every kiddo. (laughing) That would be wonderful. I got the iPad in late October and I have started to use it with the kids and I would like to use it more.	Suggests high tech device Explosion Fad	What are some ways you are using the iPad with students? How does the iPad benefit students? How will you find out more info about the iPad?	Perceived Ease of Use or Perceived Usefulness? Are you using TAM to decide if you use a device?	I can tell from your expressions and the things you have shared with me that you are passionate about kids learning and you enjoy creating ways for kiddos to learn… You talked about iPads as AT … so tell me how you see these pieces of AT

				benefitting kids
That would be ideal for AT. In level one it is hard to have more AT.	AT for students with more significant disabilities	Why is it hard to have more AT for students in level 1?		
It is hard because one thing that is hard is "I DON'T KNOW WHAT IT IS OUT THERE SO I DON'T KNOW WHAT I WANT BECAUSE I DON'T KNOW WHAT THERE IS"	Lack of Awareness? Training?	What are some ways you would like to find out information?	Communication channels?	
I like Kurzweil for older kids it is time consuming because it is time consuming.	Time consuming	What is time consuming?	Rogers' Relative advantage	
Trainings... we try to go to as many as we can but it is sometimes hard to hear about any trainings.	Professional development Training	What are some ways you find out about trainings? Communication channels?	Communication channels? Rogers' elements of diffusion	
Like I said we see it more in the level II kiddos who aren't	AT for kids with more significant disabilities	What type of AT would you see for level I kids?	Innovator? Early Adopter?	One time you said AT is amazing for kiddos...

speaking. Maybe I need to be using more and I just don't know what is out there.	Awareness			Why is it amazing? What does it do for kiddos?
I bought a POGO. I plug my camera right into the usb port and print the picture right here. It is a small picture but just what I needed. I bought it on Amazon for about 30 bucks and the film is cheap. Super cheap. So easy.	Easy to use Low cost convenient	What are the criteria you use to choose AT?	Rogers's Relative Advantage, Compatibility, Complexity?	
The awareness of it.... what is out there.... I would say the "fad" of it too. Kurzweil was this big thing and we all got trained and spent $1000s of $s and then next thing was the iPad. (big drama, hands in air raised voice) In general, it is changing. Like alphasmarts...	Awareness Fad Always changing Explosion Out dated?	How did you acquire the Kurzweil? iPad?	Rogers's Relative Advantage, Compatibility, Complexity, Trialability?	

tons and tons of alphasmarts and then they were old.				
Then I had to amend it so this year I put a whole list things like, teach town, video modeling, picture cues and then on or off the computer. I want that AT in there but I do not want it so specific that I am amending the IEP every month because with these kids it changes their interests change and their needs change . It is tough. I did not have time to get kurzweil in ... I mean it was horrible. I took it out just because I could not get it in.	Legal	How do you decide to put AT devices into the IEP or take AT devices out of the IEP?	Rogers's Relative Advantage, Compatibility, Complexity, Trialability?	
It is amazing for kids in the level 3 program.	Benefit	What can it do for students		One time you said AT is amazing for kiddos... Why is it

				amazing? What does it do for kiddos?
I do not remember any in .... I might have heard it once in my training.	Pre-service training	What classes did you talk about AT in? Did you have any hands on experience with AT?		What are some ways that you have learned about AT?
Yes I have my masters from Walden. My masters is in early literacy.	Level of education	What did you learn about AT in your masters program?		
Be great to learn what is out there for AT for level I kiddos	awareness	How could you find out about more AT?	Level of Adopter?	

APPENDIX D
CATEGORIES TO SUBCATEGORIES EXAMPLE
Participant: Mary

This coding was completed by physically cutting apart the transcribed responses and taping them into categories. The pages were then copied again and cut apart to rearrange under subcategories. This process is represented in chart form here.

Participant's Response	Initial Category	Revised Category	Subcategory
Oh this is what we have done in the past so we are just going to click that box and here it is... I think I only on one of my student's IEPs is AT. In k-1	Assistive Technology Process	IEP Team Guides the Assistive Technology Process	Inherited Decisions
talking to their [the student's] speech-language pathologist and maybe their OT [occupational therapist] and I mean pulling in everyone's opinion	Assistive Technology Process	IEP Team Guides the Assistive Technology Process	Inherited Decisions
Mary stated she uses what is on a previous IEP to make assistive technology decisions. Assistive technology "is kind of skipped it if it's a child who has a review and it is yep they have had this in the past or nope they don't need this".	Assistive Technology Process	IEP Team Guides the Assistive Technology Process	Inherited Decisions

APPENDIX E
CONSTANT COMPARATIVE THEME DEVELOPMENT
Lisa, Mary, and Sara

	Lisa's Quotes	Mary's Quotes	Sara's Quotes
Theme 1: Diversity in shared Assistive Technology Experiences	"Since I have been new, I just say OK and yah that sounds good [During student teaching] No I only sat in on one IEP and she did not use any AT	I think just having people telling you that these things are out there	You can't claim that you do not know about it. You have to go out and find it
Theme 2: IEP Team Guides the Assistive Technology Process	Yeah that section where you check the box, I would just say we have no AT and we move on	talking to their [the student's] speech-language pathologist and maybe their OT [occupational therapist] and I mean pulling in everyone's opinion and seeing generally what's best for that student	Anything that the parent is looking at for home; like independent skills, or living skills, and then we talk about how to meet those needs at the meeting
Theme 3: Reliance and Resources	For purchasing stuff she is the go to just because she is the principal Other staff is a great support and having Mary as my mentor and right there and having my principal and my paras	My principal is one of the biggest supports I have	I love my administration, they support the kids talked and called some people
Theme 4: Academic and Student Independence Benefits	stuff that will help your child be more focused or more successful at school	It is amazing for kids in the level 3 program So the child could be more independent... not necessarily more independent but beyond	It [assistive technology] is not a choice it is part of their everyday learning

		this room, out in the hallway, in the general education classroom	
Theme 5: Limited Awareness of AT as a Significant Barrier	I think Read Naturally is very helpful	It is hard because one thing that is hard is "I DON'T KNOW WHAT IT IS OUT THERE SO I DON'T KNOW WHAT I WANT BECAUSE I DON'T KNOW WHAT THERE IS" I feel there is always a need for more information	I think I was self-motivated because I saw this is what my students needed to survive

APPENDIX F
SETT FRAMEWORK

Assistive Technology Consideration: Student, Environment, Tasks and Tools (SETT)

An Assistive Technology Device is any item, piece of equipment, or product system that is used to increase, maintain, or improve the functional capabilities of a child with a disability.
An Assistive Technology Service is any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. IDEA, 2004 P.L. 108-446, Section 602

Student: _____ Grade/Age: _____ School Building: _____ District: _____ ____
Contact/Case Manager:_____ E-Mail: _____ Date:_____
Team Participants (Names/Titles):

AT Consideration: Select the instructional or access areas in which the student is experiencing difficulty completing daily tasks and/or goals.

Y	N	Written Expression	Y	N	Spelling	Y	N	Reading	Y	N	Math	Y	N
		Study/Organizational Skills											
Y	N	Communication	Y	N	Listening	Y	N	Vision	Y	N	Daily Living Activities	Y	N
		Seating/Positioning											
Y	N	Recreation/Leisure	Y	N	Mobility	Y	N	Hearing	Y	N	Environmental Control	Y	N
		Pre-Vocational/Vocational											
Y	N	Other-Specify:											

If yes (and linked to an IEP goal, identify that goal(s):

Discuss the Student, Environment and Tasks, deciding what the student needs to do in different environments. Lastly... look at the most appropriate tools to accomplish those tasks.

STUDENT What are the student's needs? (Instructional areas?)	**ENVIRONMENT** Classes/situations where help is needed	**TASKS** Tasks student needs to be able to accomplish	**TOOLS** (Complete Last) What AT tools or services will address these tasks? (Current, New or Additional)

Conclusion: Highlight one of the three conclusions below (Select the text and click the 'Text Highlight' button in the toolbar.)

- Student's needs are being met WITHOUT assistive technology => 'considered but not needed' on the IEP.
- Student's needs are being met WITH assistive technology => List items and related support services on the IEP.
- AT concerns continue to exist => Further assessment is necessary.

These are the questions a team should ask itself when considering AT for a student.

The STUDENT	The Student's learning ENVIRONMENTS	The TASKS the student is being asked to complete	The TOOLS the student has or may need to complete the tasks
• What does the Student need to do? • What are the Student's special needs? • What are the Student's current abilities?	• What materials and equipment are currently available in the environment? • What is the physical arrangement? Are there special concerns? • What is the instructional arrangement? Are there likely to be changes? • What supports are available to the student? • What resources are available to the people supporting the student?	• What naturally occurring activities take place in the environment? • What is everyone else doing? • What activities support the student's curricular goals? • What are the critical elements of the activities? • How might the activities be modified to accommodate the student's special needs? • How might technology support the student's active participation in those activities?	• What no tech, low tech, mid tech and high tech options should be considered when developing a system for a student with these needs and abilities doing these tasks in these environments? • What strategies might be used to invite increased student performance? • How might these tools be tried out with the student in the customary environments in which they will be used? • Does the student require accessible, alternate format versions of printed textbooks and printed core materials?

Assistive Technology Assessment Checklist

SEATING, POSITIONING AND MOBILITY
_ Standard seat / workstation at correct height and depth
_ Modifications to standard seat or desk
_ Alternative chairs
_ Adapted / alternate chair, sidelyer, stander
_ Custom fitted wheelchair or insert

MOBILITY
_ Walking devices – crutches / walker
_ Grab bars and rails
_ Manual wheelchair
_ Powered scooter, toy car or cart
_ Powered wheelchair w / joystick or other control
_ Adapted vehicle for driving

COMMUNICATION
_ Concrete Representation
_ Simple speech generating device
_ Speech generating device with levels
_ Speech generating device with icon sequencing
_ Speech generating device with dynamic display
_ Text based device with speech synthesis

COMPUTER ACCESS
_ Positioning of student
_ Standard Keyboard/Mouse with accessibility / access features built into the operating system
_ Standard Keyboard / Mouse with Adaptations
_ Rate Enhancement
_ Alternate Keyboard/Mouse
_ Onscreen keyboard
_ Voice recognition software
_ Eye Gaze
_ Morse Code
_ Switch Access

MOTOR ASPECTS OF WRITING
_ Environmental and seating adaptations
_ Variety of pens / pencils
_ Adapted pen / pencil
_ Writing templates
_ Prewritten words / phrases
_ Label maker
_ Portable word processor
_ Computer with accessibility features
_ Computer with word processing software
_ Alternative keyboards
_ Computer with scanner
_ Computer with word prediction
_ Computer with voice recognition software

COMPOSITION OF WRITTEN MATERIAL
_ Picture Supports to write from/about
_ Pictures with words
_ Words Cards / Word Banks/Word Wall
_ Portable, talking spellcheckers / dictionary / thesaurus
_ Word processing software
_ Word prediction software
_ Digital templates
_ Abbreviation expansion
_ Word processing with digital supports
_ Talking word processing
_ Multimedia software with alternative expression of ideas
_ Tools for citations and formats
_ Voice recognition software

READING
_ Book adapted for access
_ Low-tech modifications to text
_ Handheld device to read individual words
_ Use of pictures/symbols with text
_ Electronic text
_ Modified electronic text
_ Text reader
_ Scanner with OCR and text reader
_ Text reader with study skill support

MATHEMATICS
_ Math manipulatives
_ Low-tech physical access
_ Abacus / math-line
_ Adapted math paper
_ Adapted math tools
_ Math "smart chart'
_ Math scripts
_ Math tool bars
_ On-screen calculator
_ Alternative keyboards / portable math processors
_ Virtual manipulatives
_ Math software and web simulations
_ Voice recognition math software

SELF-MANAGEMENT
_ Sensory regulation tools
_ Movement and deep pressure tools
_ Fidgets
_ Auditory Reminders
_ Visuals

INFORMATION MANAGEMENT
_ Tabs
_ Sticky Notes
_ Highlighters
_ Key Words
_ Study Guides
_ Task Analysis
_ Digital Highlighter and Sticky Notes
_ Handheld Scanner / electronic extraction
_ Study grid generators / grading rubrics
_ Online search tolls
_ Online webtracker
_ Online sorting file tools
_ Digital Graphic Organizer
_ Online manipulatives, interactive, tutorials, animations

TIME MANAGEMENT
_ Checklist
_ Paper planners / Calendars
_ Visual Schedules
_ Portable, adapted timekeepers
_ Electronic reminders
_ Digital planners
_ Web-based planning tools

MATERIAL MANAGEMENT
_ Low-tech organizers
_ Checklists
_ Container System
_ Coding System
_ Electronic filing and storage
_ Portable electronic storage
_ Computer-based tools
_ Tactile measuring devices
_ Abacus
_ Talking calculator
_ Models or 2D and 3D geometric shapes
_ Tiger embossed, PIAF Tactile representation

RECREATION AND LEISURE
_ Typical toys / puzzles / balls / utensils / etc adapted
_ Flexible rules
_ Specially designed utensils / equipment
_ Electronically / mechanically adapted utensils / equip.
_ Electronic aids – remote controls, timers, etc.
_ Computer-facilitated / based activities
_ Online / Virtual recreational experience

VISION – COMPUTER ACCESS
_ Color scheme
_ Large operating system features
_ Built-in magnification
_ Fully-featured magnification
_ Screen reader
_ Screen reader with Braille device

VISION – READING
_ Glasses
_ Color Filter
_ Slant-board
_ Large print
_ Optical Magnifier
_ Electronic Magnifier
_ CCTV
_ Monocular
_ CCTV with distance camera
_ Audio text
_ Computer-based reading software
_ Electronic Braille note-taker

VISION - MATHEMATICS
_ Large print measuring tools
_ Large key calculator
_ Tactile measuring

VISION – WRITING
_ High contrast pen
_ Portable word processing device
_ Typing with audio support
_ Braillewriter
_ Typing with Braille support
_ Electronic Braille note taker
_ Voice recognition

VISION – MOBILITY
_ Cane
_ Monocular
_ Braille / talking compass
_ Electronic travel device
_ GPS device

VISIONS –PICTORIAL INFORMATION
_ Enlarged format
_ CCTV
_ Models or objects
_ Tactile graphics
_ Tactile-audio graphics

VISION – NOTE TAKING
_ Slate and stylus
_ Tape or digital recording device
_ Computer-based recording software
_ Electronic Braille note taker

HEARING - TECHNOLOGY
_ FM
_ Infrared
_ Induction Loop
_ 1:1 Communicators
_ Personal amplification

HEARING - COMMUNICATION
_ Telecommunication supports
_ Closed captioning
_ Person to person
_ Classroom / group activities
_ Voice to text / sign
_ Real-time captioning

APPENDIX G
SCRIPT

Oral/Written Script for Initial Contact of Elementary Special Education Teachers

I am contacting you with information about a qualitative research project and an opportunity to participate in this project. I am interested in exploring the process and factors that teachers of students with disabilities use in adopting and utilizing assistive technology to meet the needs of their students. I am contacting you because you are an elementary special education teacher in a rural school.

One aim of the study will be to understand and become aware of the benefits and barriers of this process as they pertain to assistive technology. By identifying these benefits and barriers a better perception can be obtained to determine why assistive technology devices and services are not more prevalent in schools.

If you are interested in sharing your experiences, I would like the opportunity to interview you on three occasions for approximately 45 minutes at a location of your choosing. During these interviews you would be asked to share about your teaching experiences, your preservice training, and opportunities for professional development. If you might be interested in participating, I am happy to share more information with you, as well as the consent for participation form which details your rights as a participant in the study.

Dawn Jacobsen